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AUGUST 31, 1953

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Pantry ... Precision—s... page 2

HOW TO UNDERSTAND ALLOY STEEL

SIDE CAMS FOR DIES

BUTT-WELDING 0.005-IN. STAINLESS

brass parts precision borized

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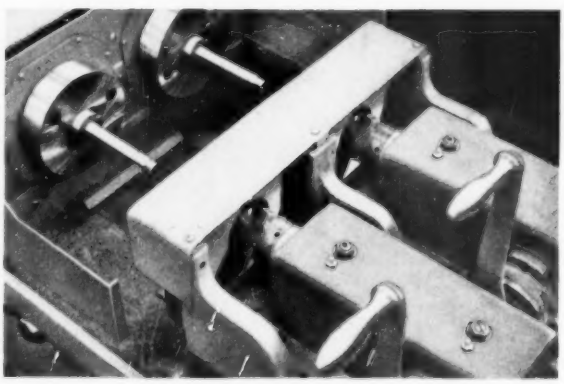

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MAGAZINE OF METALWORKING PRODUCTION

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NUMBER OF COPIES PRINTED THIS ISSUE 35,165

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc., James H McGraw (1860-1948), Founder.

EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, N.Y. Curtis W McGraw, President; Willard Chevalier, Executive Vice President; Joseph A Gerardi, Vice President, Treasurer; John J Cooke, Secretary; Paul Montgomery, Senior Vice President, Publication Division; Ralph B Smith, Vice President and Editorial Director; Nelson Bond, Vice President, Director of Advertising; J E Blackburn Jr, Vice President, Director of Circulation.

SUBSCRIPTIONS: Address correspondence to American Machinist Subscription Service, 330 West 42nd Street, New York 36, N.Y. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.

Single copies, 50c. Subscription Rates—United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, August 13, 1943, at Post Office, New York, N.Y. under the act of March 3, 1879. Printed in U.S.A.

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chips

TOOL PANTRY . . . Purdue University has a large and well-equipped machine-tool laboratory, so it is logical to expect a correspondingly fine tool crib. Our front cover shows one section of it, with almost legendary neatness and observance of the old saw about a place for everything. The bins beneath the counter are on casters so they roll out, making portable the racks, drawers or shelves they contain.

ALLOY STEELS . . . Sam Storchheim, senior metallurgist at Sylvania Electric Products, Bayside, NY, continues his explanatory basic-metallurgy series with "How to Understand Alloy Steels", our current 8-page Special Report. He explains effects of additives, heat treatment, chemical action, etc. Structures of various alloys are illustrated.

SIDE CAMS . . . Our old friend, J R Paquin, is back in this issue with an explanation of side cams for dies—how they convert the up-and-down motion of the press ram into angular or horizontal motion There are 15 sketches of various die functions, each with a lengthy explanatory caption. Stressed are the elements of good design and proper application. . . . There's also number three of Stanley Cope's series on drawing dies—a double premium for die men.

HIGH-PHOS IRONS . . . Normally, castings with more than 0.35% of phosphorus are not acceptable for machining. However, Edward A Loria, senior engineer of Research & Development, Carborundum Co, shows how 0.50% if included in castings produced under controlled conditions, gives good tool life in the range 185 to 512 fpm.

THIN STAINLESS . . . For some months, we've known about some unusual welding of parts for model submarines, but only now can we talk about it. Miniature I & T beams were butt-welded of stainless only 0.008 in. thick. M S Weinstein of the US Naval Ordnance Lab at White Oak, Md, tells how it was done by a special spotwelding technique.

WRAPPED JOINT . . . Soldering is a time-consuming and onerous job. Thus GE mechanized it by dip-soldering 400 joints in a TV chassis at once (*AM*—Aug 17, '53, p104). Now Bell Labs and Western Electric have gone on to develop and apply a tool that wraps a wire around a pin so tightly that soldering isn't necessary.

HARD RUBBER . . . Specimens of fighting-tank treads must be given tensile and compression tests. That means machining to shape. Detroit Tank Arsenal tried all normal methods. Here's an evaluation of their advantages and disadvantages, plus a special device that makes the job easier. If you machine hard rubber, don't miss this one.

COMING . . . *AM* for Sept 14 will be a hefty issue, with more than 100 editorial pages. There'll be a Special Report on mist-cooling of tools, articles on dimensional stability of gages, oil-fog die lubrication, a special press, ultrasonic soldering, tool grinding, machining hard rubber, and designing draw dies, plus others. And the cover will picture the gal who handles more diamonds than any other; "Diamond Lil" they call her.

FERROUS METALLURGIST . . . Edward A Loria is senior engineer in the Metallurgical Research Development Div, The Carborundum Company, has been with the company since 1950, specializing in ferrous-metallurgy studies. He has both his BS and MS in Metallurgical Engrg from Carnegie Institute and has had graduate work in the same subject at the University of Pittsburgh. He also won the Charles Gulentz Scholarship at Carnegie and was on the honor list. He was in the Metals Research Lab there in 1943-44, became asst metallurgist at Carnegie-Illinois Steel during 1944-46, and was a fellow and senior fellow at Mellon Institute from 1946-50. He is a member of the AIME, ASM, and American Foundrymen's Society. He is the author of our current article on machinability of high-phos irons.

ONE CUT
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16 D. P. and Finer

- Gleason No. 2 Straight Bevel Generator
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- Features Interlocking Multi-blade CONIFLEX® Cutters
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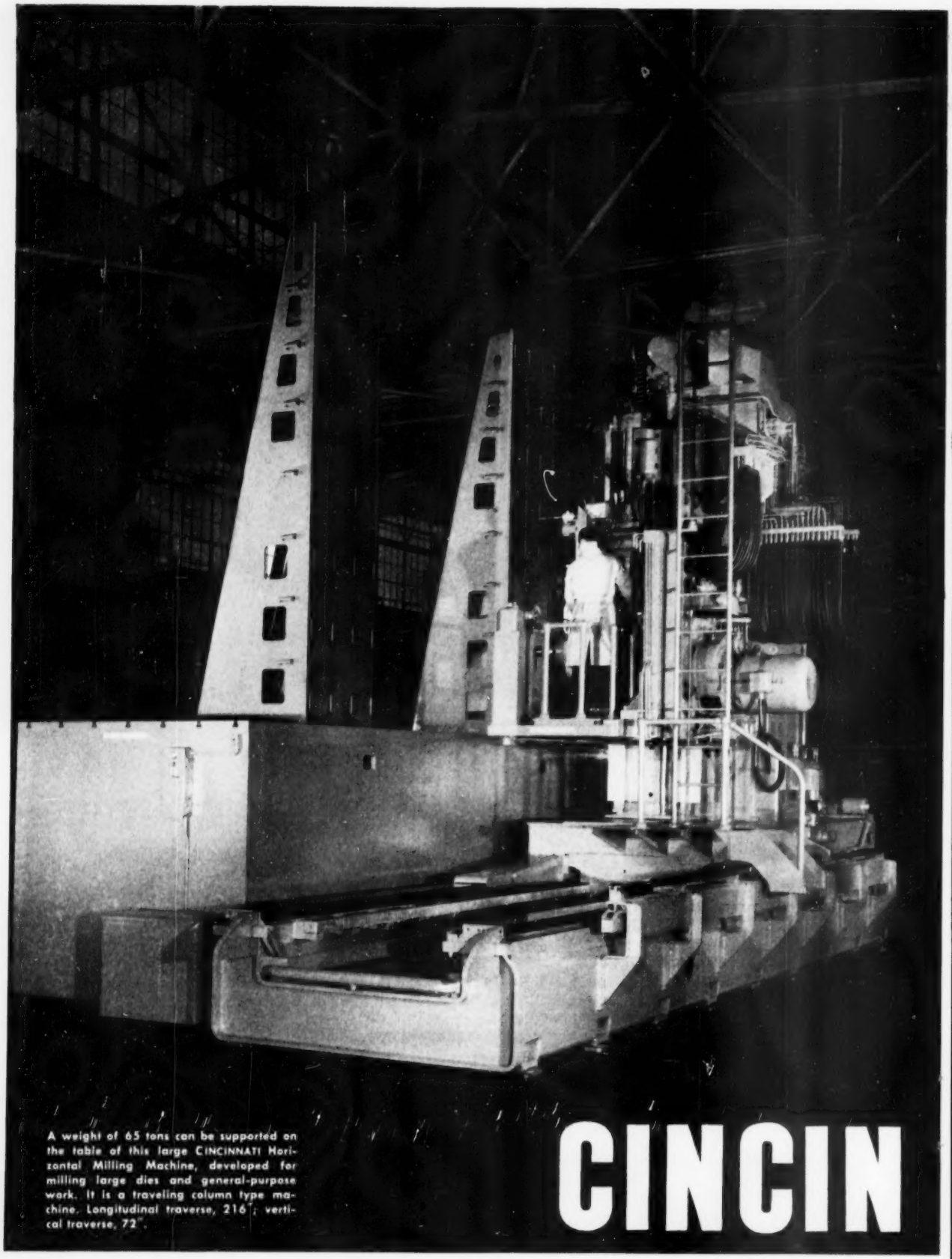

A weight of 65 tons can be supported on the table of this large CINCINNATI Horizontal Milling Machine, developed for milling large dies and general-purpose work. It is a traveling column type machine. Longitudinal traverse, 216"; vertical traverse, 72".

CINCIN

this
familiar
name plate

CINCINNATI

is attached
to these extremes
in milling machines

The smallest of the CINCINNATI line . . . No. 000-4 Unit Type Automatic. It has hydraulic table traverse, 4" range; can be mounted as one, two or four distinct milling machines on a common base. Single or progressive operations can be handled at low cost on small parts for business machines, sewing machines, etc. Sewing machine bobbins are being milled in the illustration.

Elephants and rabbits* and all the in-between sizes of milling machines have been built by Cincinnati Milling for many years. The two machines illustrated here are indicative of the range of sizes. It takes long experience and extensive research and design facilities to build such a variety of machine tools. Cincinnati has this background . . . and these facilities. They are at your service to equip your shop for the lowest cost of production.

**Elephants are Washington terminology for long delivery, large machine tools; rabbits for short delivery, small machine tools.*

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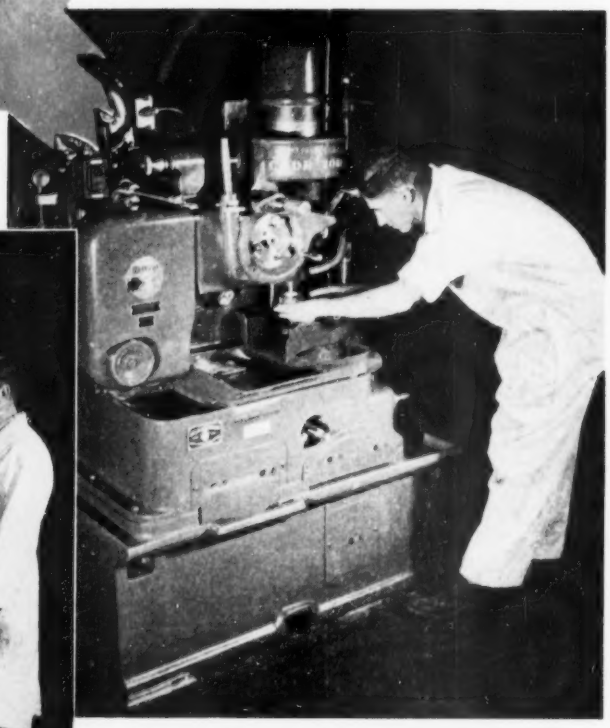
NATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

The FELLOWS METHOD
...in action!

In Canada as in the United States... PRATT & uses

Canadian Pratt & Whitney's new 340,000 sq. ft. plant at Ville Jacques Cartier, Quebec.



At the Canadian Pratt & Whitney plant, a number of small fine-pitch external gears are cut to a high degree of accuracy on Fellows 7-Type Gear Shapers.

For its R1340 Wasp engine production tooling, Canadian Pratt & Whitney relies on the Fellows 36-Z-Type (12" Straight Hole Work Spindle) Gear Shaper for precision cutting of both the external and internal splines on the crankshaft and the cam-ring internal gear.

Fellows

WHITNEY

The Fellows Method . . .

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Aircraft production in Canada, too, finds in the Fellows Method the *production and quality control* so vital to the successful manufacture of both reciprocating and jet engines. The coordinated line of Fellows equipment for cutting, finishing and inspecting gears provides close-tolerance control in every step of gear production. Wherever you are, a Fellows representative will be glad to discuss with you the control features and economy of the Fellows Methods as applied to your gear production problems.

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New

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Completely Engineered

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New Design Permits Economical Close-Tolerance Short Run or Production Grinding of Small Parts

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Especially developed for fast plunge or traverse grinding, it is particularly adaptable for toolrooms, job shops, or plants where work is usually in small or medium runs.

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- Pope wheel spindle engineered with extra-large SKF double row cylindrical roller bearings assures smooth, chatter-free finish and long operating life.
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Find out for yourself how the Van Norman 418 Cylindrical Grinder reduces over-all work completion time . . . cuts costs of grinding small parts. Write for Catalog, today. Especially inquire about the price . . . it's exceptionally low for a quality grinder.

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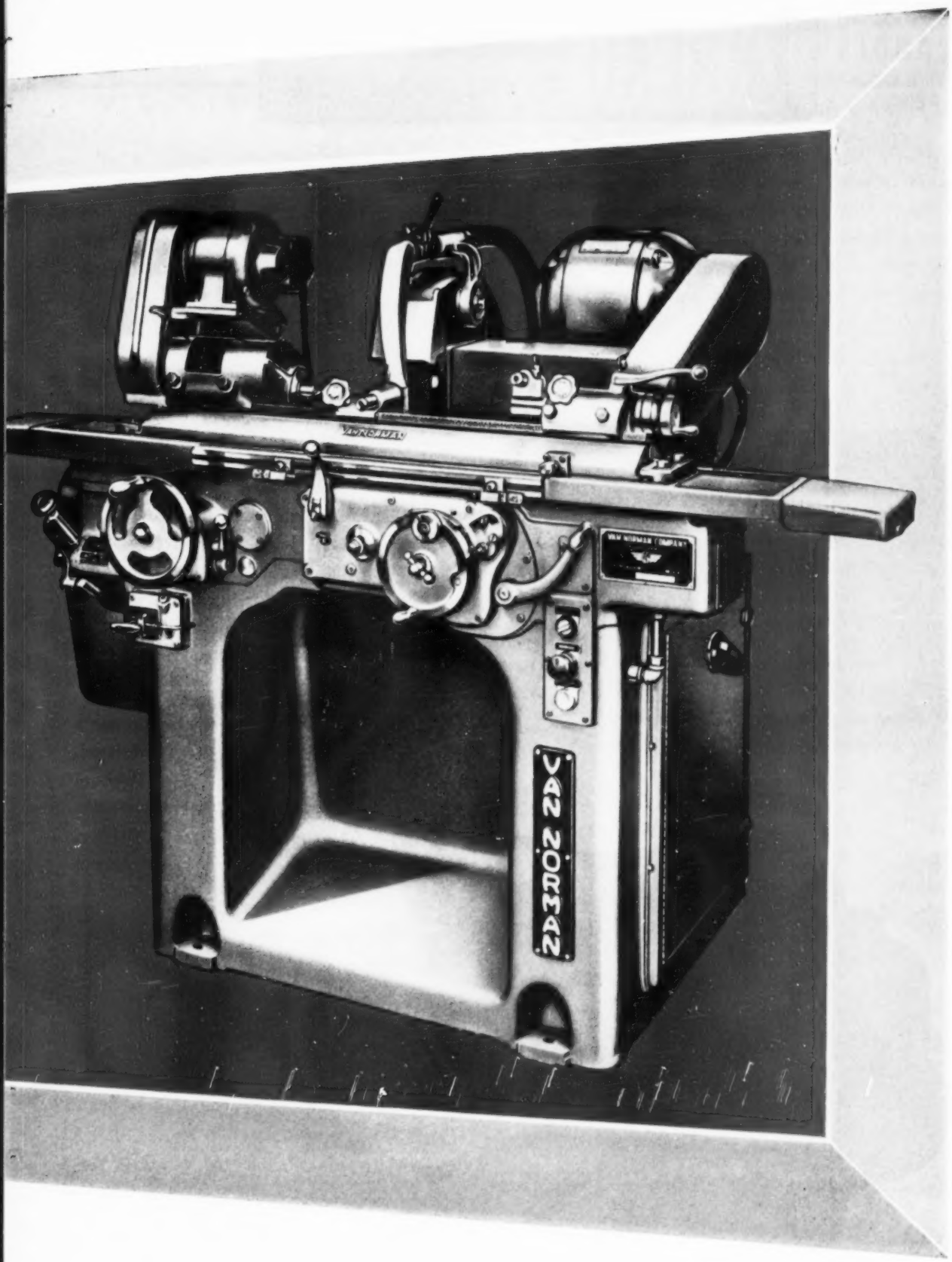
Manufacturers of Precision Grinders Since 1912


VAN NORMAN

LANDIS **THREAD ENGINEERING DEVELOPMENTS** MACHINE

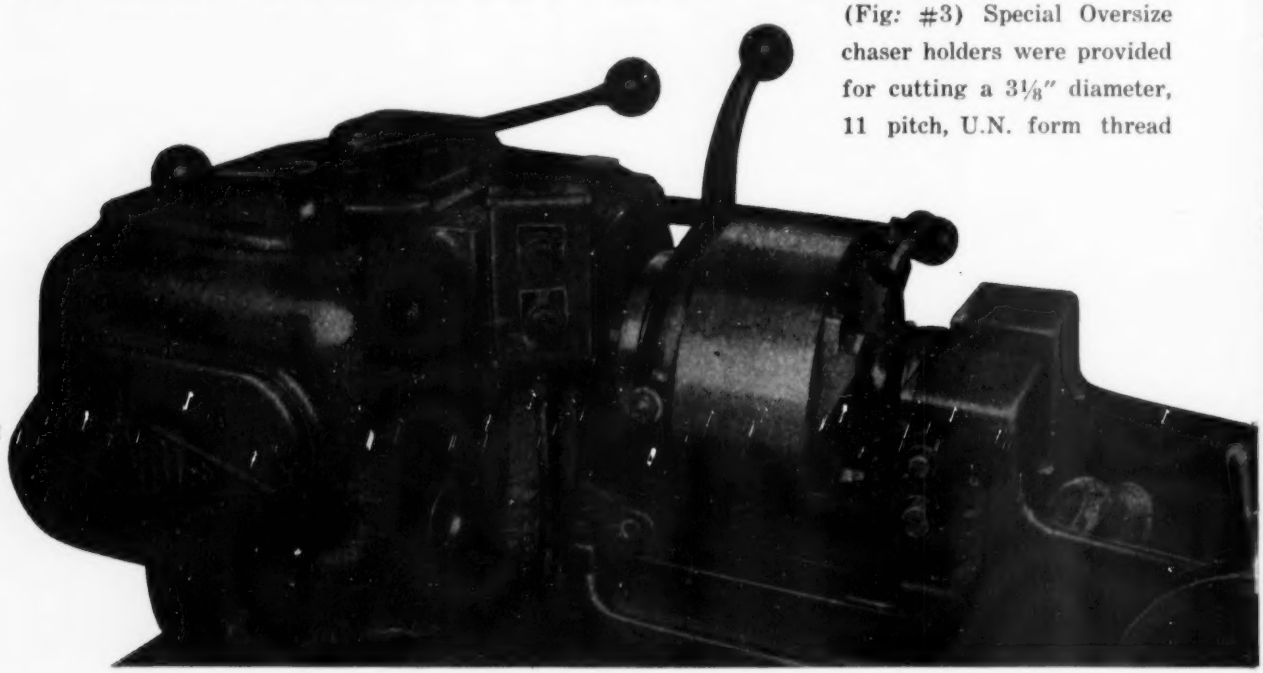
WORLD'S LARGEST

Landmaco Machine Threads Bell-shaped Gas Cylinder Collars

HARRISBURG Steel Corporation was interested in securing a more productive and economical means for threading stamped steel gas cylinder collars. Their threading problem arose mainly from the unusual bell shape of the work piece (Fig. #1), which made chucking difficult.

To solve their problem a 1½" LANDMACO Threading Machine was furnished equipped with a special work holding fixture. The fixture (Fig. #2) is bolted to both vise jaws and thus rendering the vise jaws immovable, achieving the desired results of a solid carriage front. The gas cylinder collars are slipped over the arbor of the fixture and abutted against the circular abutting plate. Three semi-round drive keys, which fit into pressed key ways in the bore of the work piece, prevent it from rotating on the arbor while under cut.

The die head supplied with this machine was a 1¼" Lanco Internal Trip Heat Treated Head. (Fig. #3) Special Oversize chaser holders were provided for cutting a 3⅛" diameter, 11 pitch, U.N. form thread



$1\frac{5}{16}$" in length. Internal tripping, by which the work piece opens the die head, assures the same thread length on each collar regardless of their variance in height. It also prevents any possibility of chaser breakage or die head damage by running the work piece too far into the die head while threading. The bell shaped design of the trip bar facilitates the alignment and holding of the collar on the work holding fixture while under cut.

FIG. 1

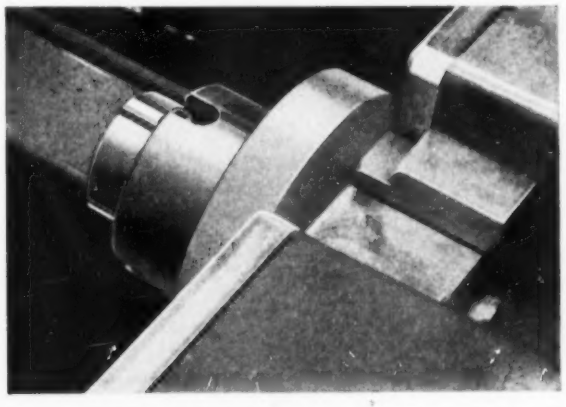


FIG. 2

Although special oversize chaser holders were furnished for this threading job, the chasers used in these holders were standard 11 pitch, U.N. form chasers. These chasers were supplied from our large chaser inventory and can be replaced immediately when the need arises. Usage of these chasers is not restricted to the diameter for which they were provided. They may be used for any diameter within the range of the die head by using proper chaser holders and if the thread form and pitch remain constant.

Now in operation at Harrisburg Steel, this machine has increased production and reduced threading cost on gas cylinder collars to their complete satisfaction. This is but one example of the many special work holding fixtures designed by Landis which enable the production of quality threads on unusual work pieces.

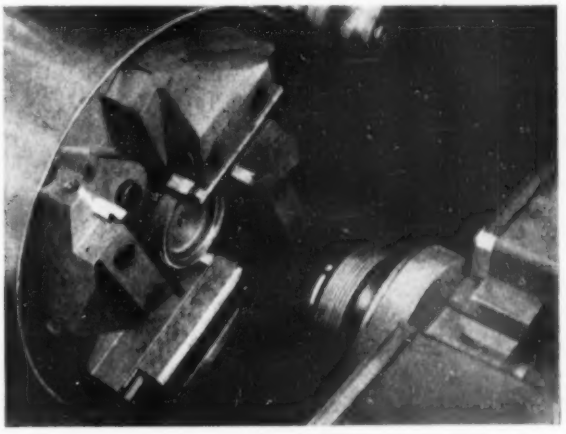


FIG. 3

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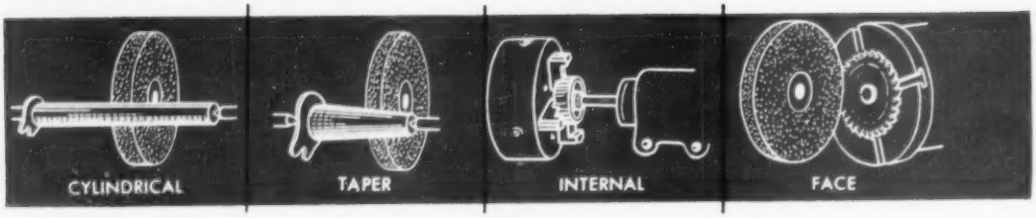
WAYNESBORO-9 · PENNSYLVANIA · U.S.A.

Your Best Buy in Small Grinders



A Universal Grinder +

167

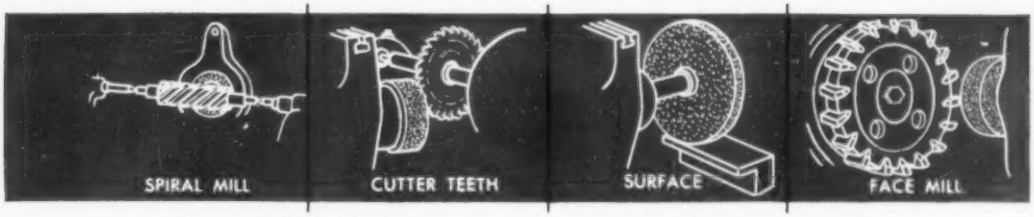
Landis 12" x 28"
Universal and Tool Grinder

LANDIS

precision grinders

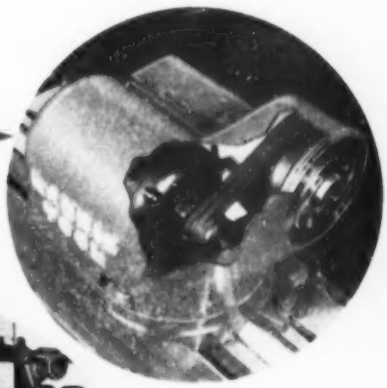
Write for Catalog K-53 for full information on the 24 different grinding operations that can be performed on this versatile machine both as a universal grinder and as a tool grinder. In includes specifications and features of this machine together with setup pictures of typical grinding operations.

2 machines in one—at low capital investment



A Tool Grinder

You really get two machines in one with the Landis 12" x 28" Universal & Tool—an ideal one machine grinding department for the tool room or small shop at a big saving in capital investment over separate machines.

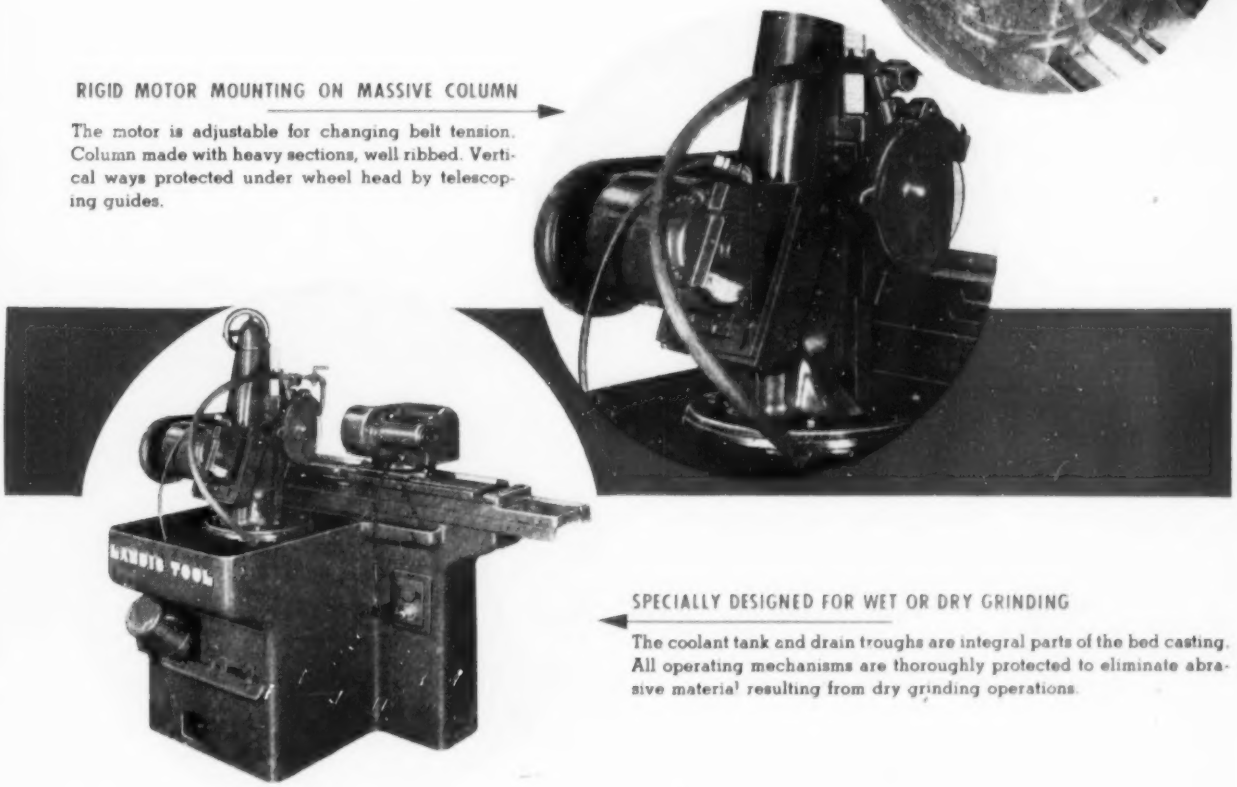


COMPACT ALL VEE-BELT HEADSTOCK

Low compact headstock particularly good for face grinding operations. All Vee-belt drive assures smooth power and fine finishes. Only two revolving parts; the electric motor and face plate or spindle.

RIGID MOTOR MOUNTING ON MASSIVE COLUMN

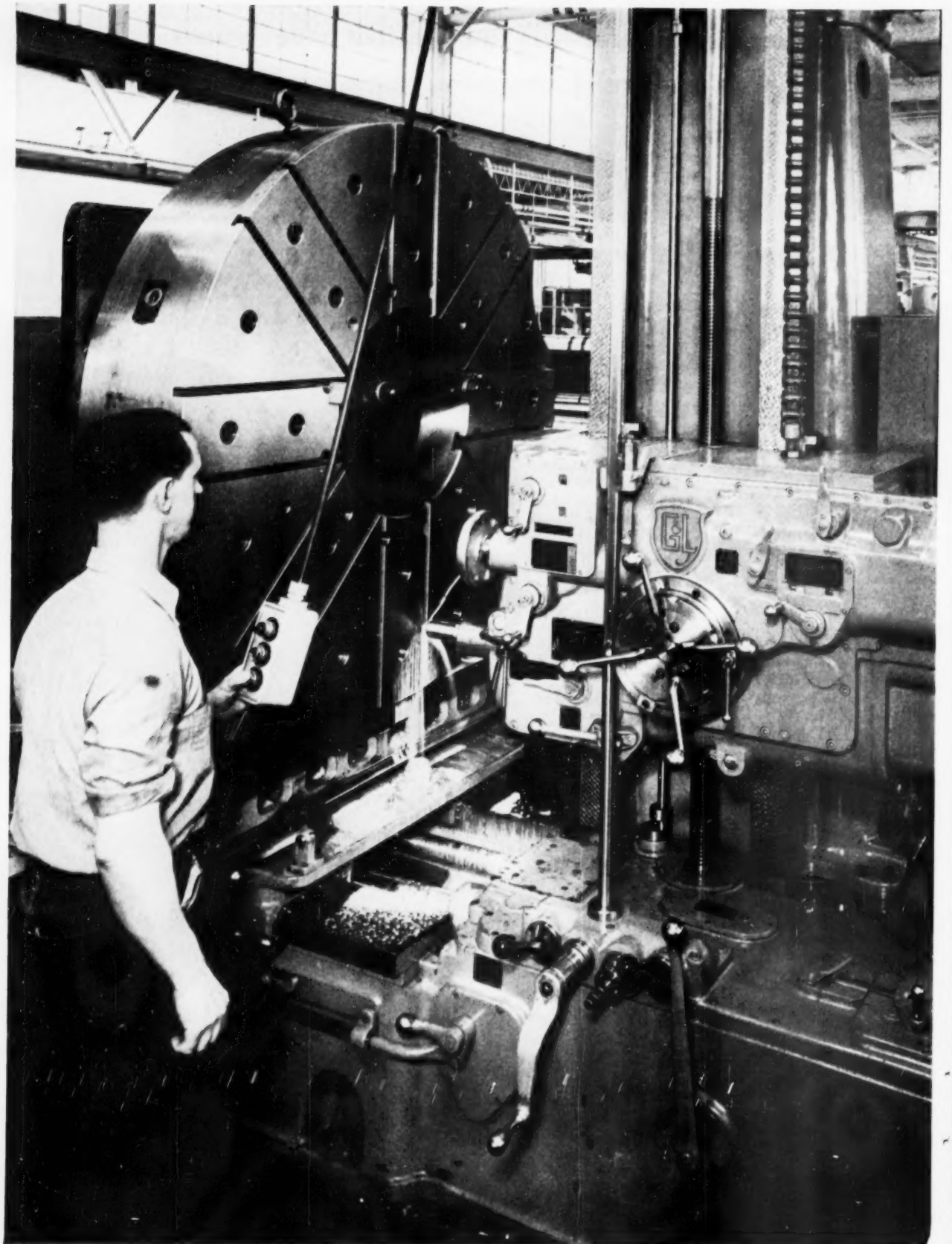
The motor is adjustable for changing belt tension. Column made with heavy sections, well ribbed. Vertical ways protected under wheel head by telescoping guides.



SPECIALLY DESIGNED FOR WET OR DRY GRINDING

The coolant tank and drain troughs are integral parts of the bed casting. All operating mechanisms are thoroughly protected to eliminate abrasive material resulting from dry grinding operations.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U.S.A.



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to end production headaches!

This versatile machine helps you eliminate problems of overly long floor-to-floor time . . . frequent, complicated setups...and expensive re-runs on close tolerance work. It's the G & L 30-Series table type Horizontal Boring, Drilling and Milling Machine

For either long production runs or custom jobs, G&L 30-Series machines offer you many advantages to speed work, cut costs and increase shop flexibility. They feature an unusually wide range of speed and feed selections, extreme rigidity and accuracy, plus easy, positive control.

In addition, for special jobs or special problems, they are available with a host of attachments and accessories. Any one piece of optional equipment may help you turn a previously losing proposition into a real profit-maker. This equipment includes: an Automatic Electric Positioning Device, built-in or separate revolving tables, angular milling attachments and continuous feed facing and boring heads.

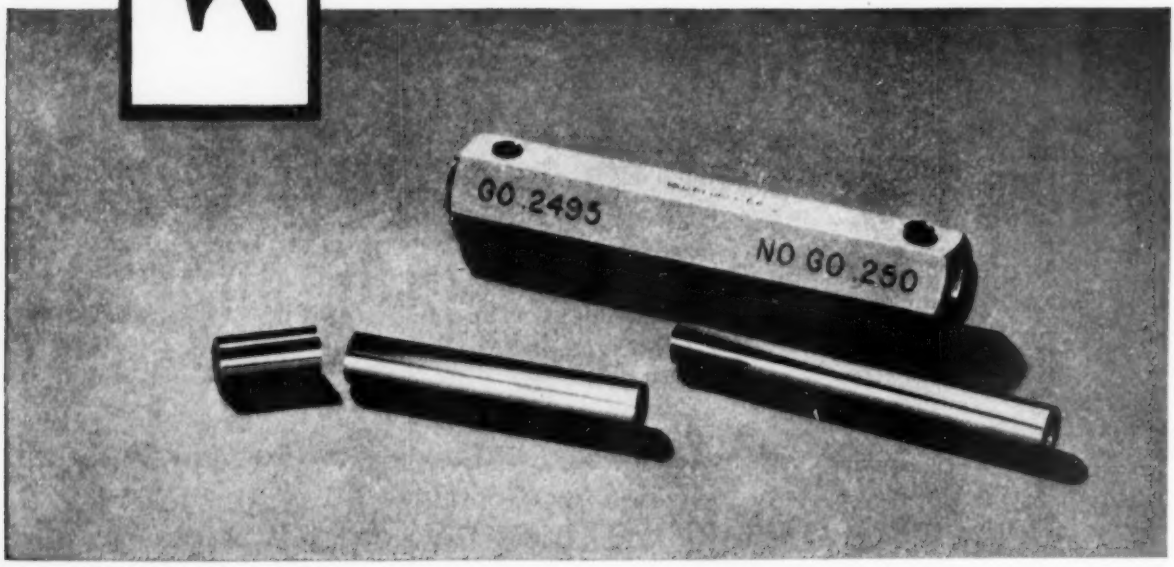
G&L table type machines are available with 3, 4, 5, 6 and 7 inch diameter spindles. Any model is available in a choice of four basic table and saddle arrangements in various sizes. For complete details on these cost-cutting, work-speeding machines, see your G&L representative or write —

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Open Side Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

VK WIRE TYPE PLUG GAGES



VASTLY LONGER-LIVED *and* MONEY-SAVERS . . .

because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "They're not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below ⅜" may be cut off when ends become worn and as many as from five to ten gages made available from the 1⅞" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 35, available on request by writing to: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

VK

34th YEAR

THE Van Keuren CO.

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

No. 3 in a Series

Conomatics demonstrate carbide tools

We believe you know that not every "automatic" job can be tooled successfully with 100% carbide. What we think you may not know is that the Conomatic Carbide Development program is making progress with such jobs. This relatively new Cone service is convincing to those who like to be shown that "it can be done".

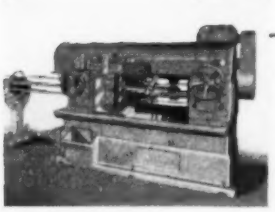
Granted that experimental runs are not production runs, it has often been proved that under actual production conditions they have developed into production runs. A number of conditions must be met in the successful use of any tooling material. Carbide is no exception. If the comparisons of 100% carbide and HSS runs indicate as much gain as per the job illustrated, the reward is worth the effort.

For full particulars please consult your Cone Representative or inquire direct.

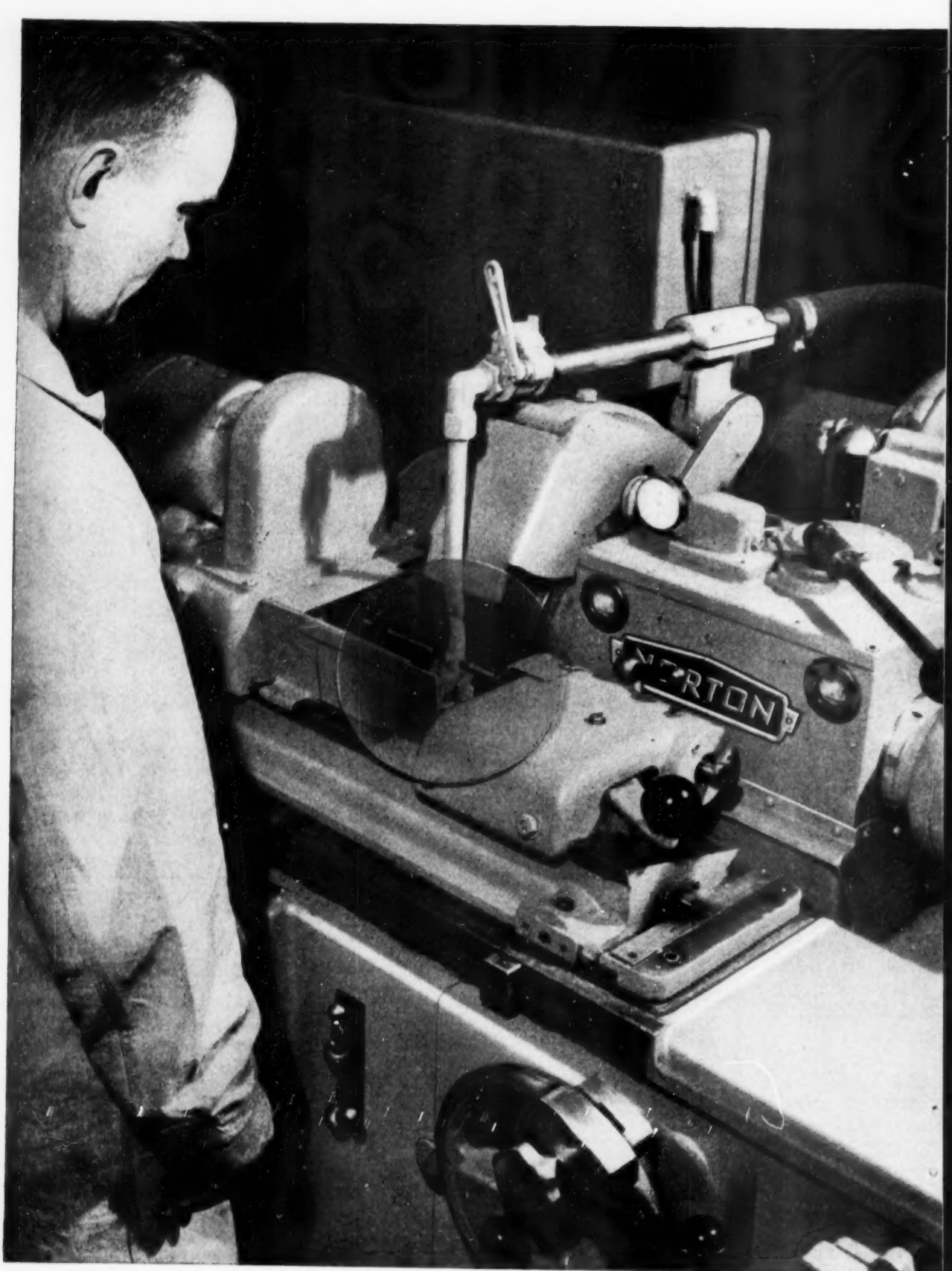
MATERIAL—EVERDURE: (96% copper, 3% silicon, 1% manganese) Hole drilled with 17/32" drill to 1½" depth; thread rolling of ½" pipe thread.

	HSS	CARBIDE
Cycle Time	35 secs.	15 secs.
Work Spindle Speed	420 R.P.M. at 124 S.F.	850 R.P.M. at 250 S.F.
Tool Wear	2000 pcs. per grind	5000 pcs. per grind

The CONOMATIC is the ONLY representative of Frame "A". The short, "weave-proof," upright members, secured between larger and heavier top bed and base, make possible the strongest type of bridged support to the tooling area and its "work and tool axis."



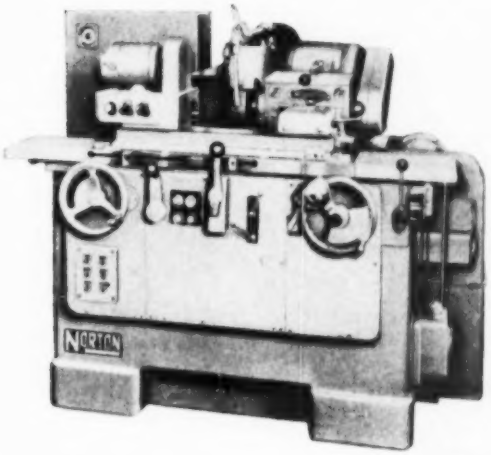
Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.


NORTON

SMALL PARTS PAY OFF BIG . . . WITH THIS

"TOUCH OF GOLD"

The new Norton 4" type CTU Cylindrical Grinder gives you high precision plus high production



Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations — in 12" or 18" work length capacities in both models.

Either way you'll get the added "Touch of Gold" by faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton offers you such long experience in both grinding wheels and machines — your assurance of the value-adding "Touch of Gold" that means better products at lower cost. NORTON COMPANY, Worcester 6, Mass.

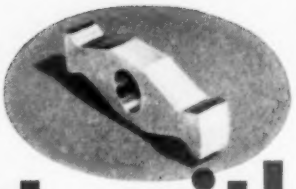
To Economize Modernize With **NEW**

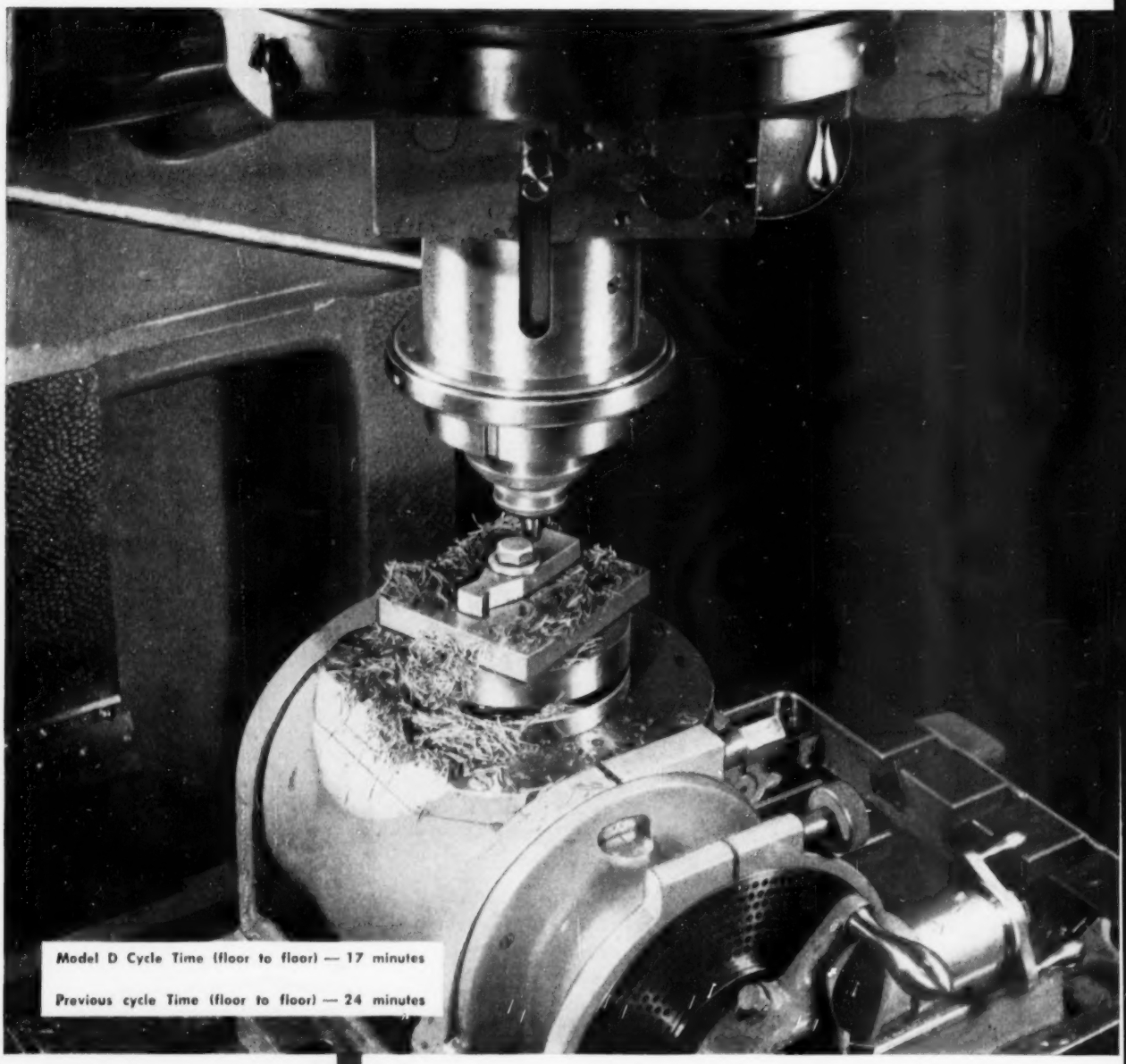
NORTON

GRINDERS *and* LAPPERS

Making better products to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

This part  is the blueprint, with a



PRODUCTION DATA

Part	Control Valve Lever	**Spindle Speed**	530 rpm
Material	SAE 1020	**Lot Size**	50 pieces
Cutter	½ in. — 2-lip HSS End Mill	**Machine**	Model D

finish-milled direct from single setup, in 17 min.!

Kearney & Trecker Model 2D Rotary Head Milling Machine saves six hours on 50 piece run

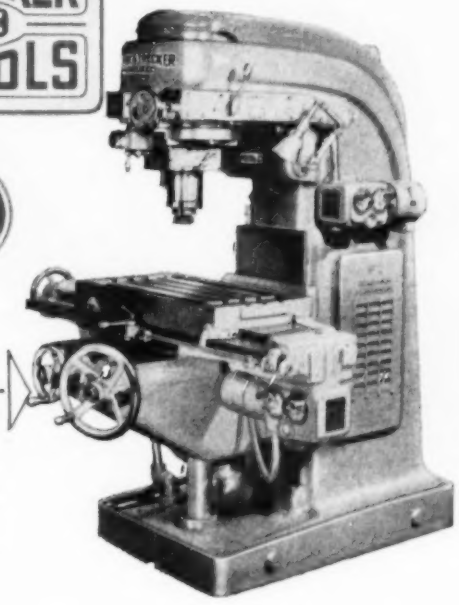
HERE is another example of the tremendous time and tooling savings possible with the rotary head milling method.

This manufacturer used to complete a control lever every 24 minutes. Now the same work is completed in only 17 minutes. . . . and no multiple setups or expensive form cutters are necessary. The blueprint is the only guide the operator needs — the machine's precise mechanical control of the cutter's angular and radial movements does the rest.

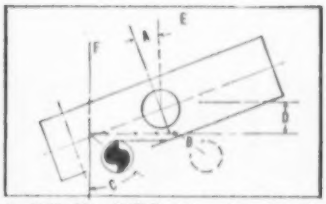
Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

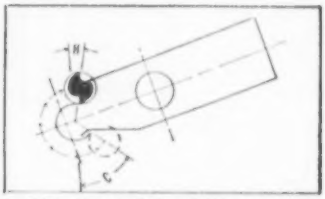
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS



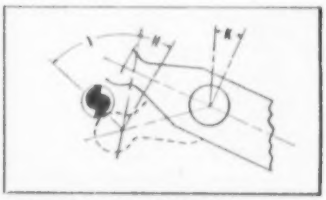
THIS IS THE MACHINE that will handle your light production milling faster, easier and at tremendous savings over any other method. If you have any production problems in plastic molds, die-casting, forging and stamping dies, or selected production milling operations — it will pay you to investigate the Model 2D Rotary Head Milling Machine.



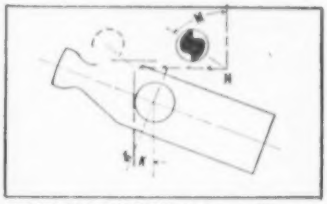
1. MILL 20° ANGLE. Index piece to angle (A), offset spindle slide to radius (B), set rotary head to angle (C), saddle to (D). Feed table (E) to (F).



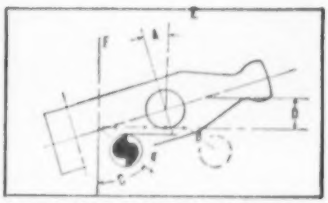
2. MILL .642/.645 DIAMETER. Rotate head angle (C) to angle (H).



3. MILL 1⅛ IN. RADIUS. Rotate head from angle (H) to angle (J), index dividing head from angle (A) (Oper. 1) to angle (K).



4. MILL 20° ANGLE. With piece at (K), move center of head to (L), rotate head to (M). Feed table (L) to (N).



5. MILL SAME FORM ON OPPOSITE END. Repeat operations 1 through 4 by indexing the workpiece to angle (A-Oper. 1).

WARNER & SWASEY 5-SPINDLE AUTOMATICS GIVE THOR A MORE FLEXIBLE TURNING DEPARTMENT

Seven Warner & Swasey 5-Spindle Automatics in plant of Thor Power Tool Co., Aurora, Illinois.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY

A few of the 1500 air and electrically powered tools made by Thor.

INCREASED SALES VOLUME, new models, and constantly varying demand for different tools created this need at Thor Power Tool Co., Aurora, Illinois. And Thor found the answer in two Warner & Swasey 5-Spindle Automatic Bar Machines.

Most of the production on Thor's wide range of power tools, involving many different parts, is short and medium run work. Their conventional multi-spindle machines were idle too much of the time for setup changes. And because of close tolerances and tough work materials, second and third operation work from the automatics had to be done on other machines.

The new Warner & Swaseys, with *quick-set* quadrant mechanisms for stroke and feed changes, drastically cut downtime, taking over marginal jobs from single as well as the conventional multi-spindle automatics. They improved the balance of work everywhere. Changeovers on similar jobs now run only about an hour, so they can handle even 100-piece lots in cascaded work. Complete change of setup averages only 3½ hours.

Because of their outstanding success with these 5-Spindle Automatics, Thor has since added five more. The addition of Warner & Swasey Automatics to *your* plant can similarly give you the advantages of high precision mass production —plus the flexibility to handle smaller lots economically.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

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Are You making full use of your "friend in time of need?"

He's no "fair-weather friend"—your Morse-Franchised Distributor. He's your *first aid* in time of trouble, when time's a-wasting. Whatever you need in Morse Cutting Tools, he's got it or can get it on the jump. And he knows his book on engineering these tools to your job. Yes, he's right on the spot to save you production time . . . not to mention purchasing and bookkeeping time, too.

So always call your Morse-Franchised Distributor for the best service on the best cutting tools made. Remember . . . *when he walks in the door, trouble flies out the window.*

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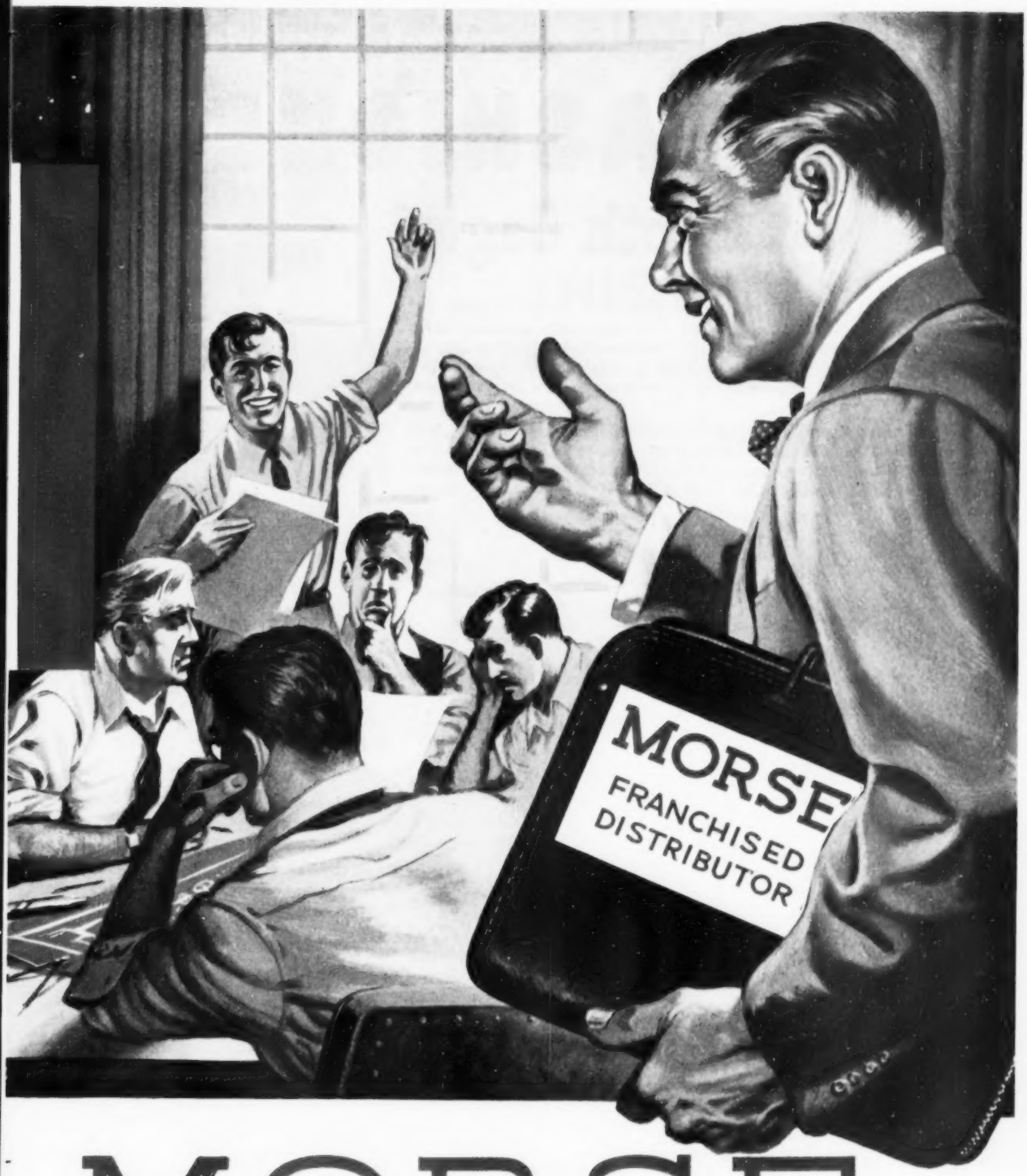
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco



MORSE

Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time

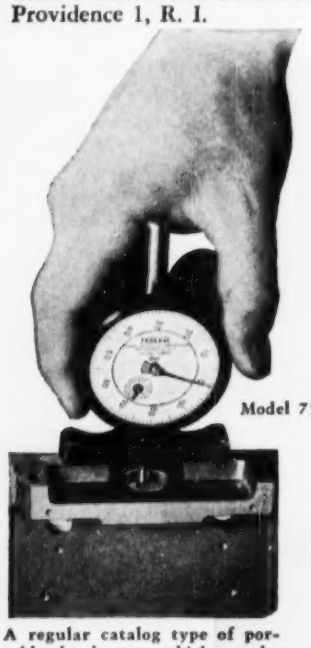
Why Fiddle Around with OLD-FASHIONED Depth Gages?

A MAN HAS TO DEVELOP A PRETTY KEEN SENSE OF TOUCH to use a flush pin gage with even reasonable accuracy. And such gages don't show any *trend* when the dimension is getting out-of-control until the operator is producing wrong depths. Micrometer depth gages are slow — they're not as fast, positive or accurate as Dial Indicator Depth Gages.

Federal offers several stock types of Depth Gages and will design and build other types to suit your particular requirements. Tell us what you need and we'll show you something to fit that need. Write, giving us the details. FEDERAL PRODUCTS CORPORATION, 1127 Eddy Street, Providence 1, R. I.

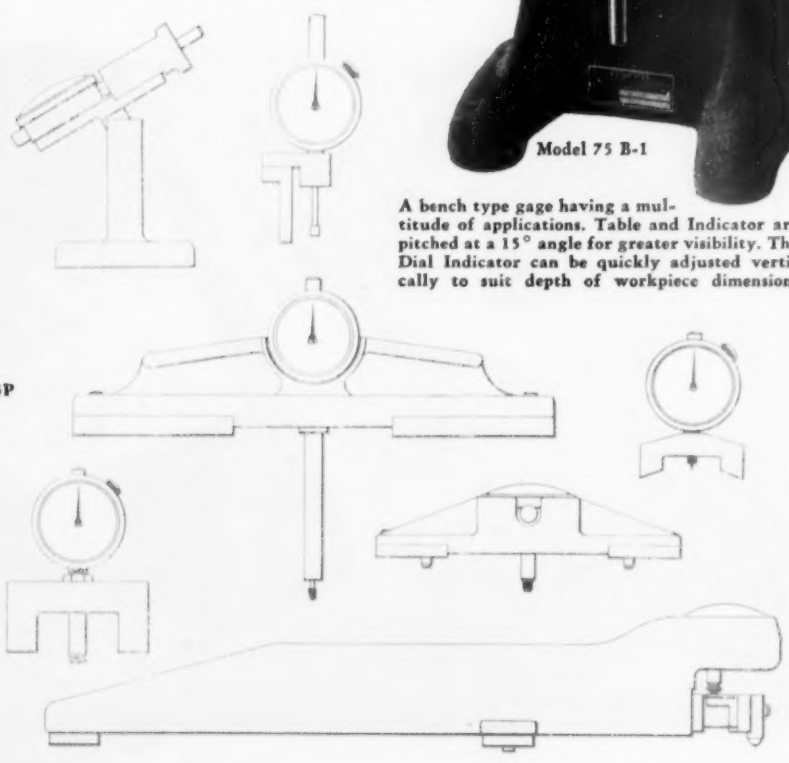
Model 75 B-1

A bench type gage having a multitude of applications. Table and Indicator are pitched at a 15° angle for greater visibility. The Dial Indicator can be quickly adjusted vertically to suit depth of workpiece dimension.



Model 75P

A regular catalog type of portable depth gage which can be had with various lengths of contact points, either radius or pinpointed, and either self-locating or push-down spindle.



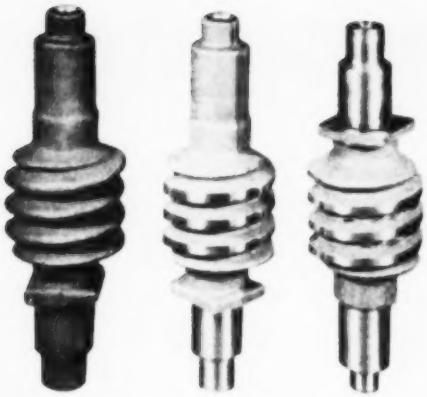
Have you seen or shown the Federal movie,

"Gaging for Profit"

It's in full-color with sound. Shows the latest developments in all kinds of gaging methods. Write for reservation.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing all types of DIMENSIONAL INDICATING GAGES



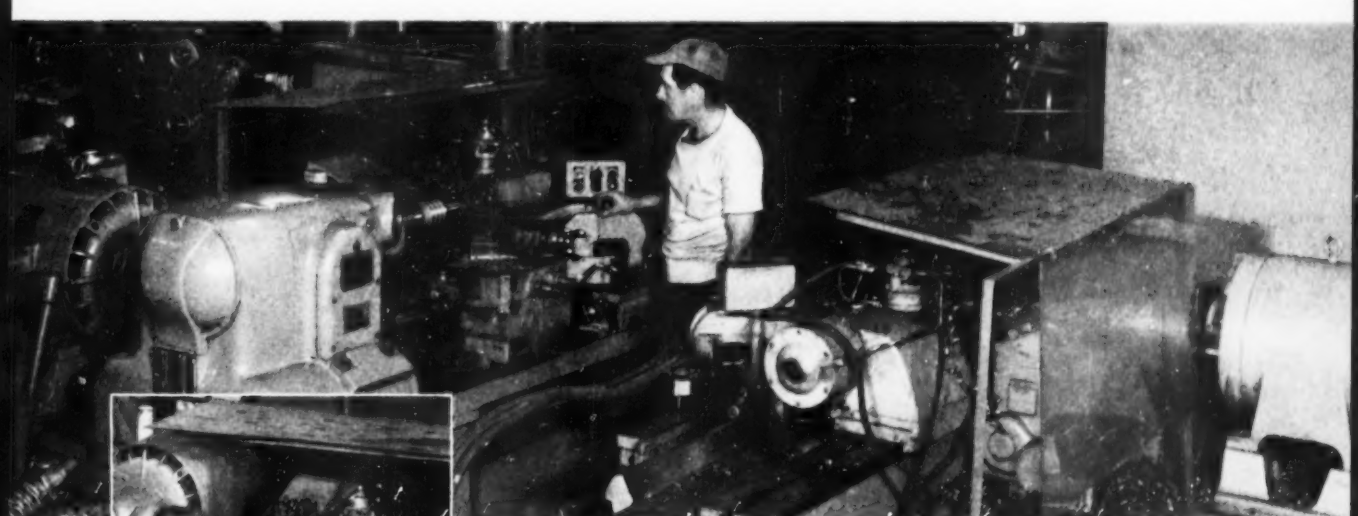
THIS EARLY BIRD GETS THREE TIMES THE WORMS!

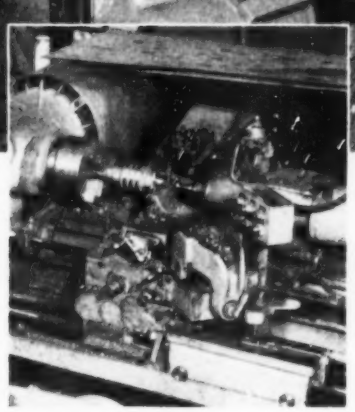
That's the Mona-Matic for you!

"THREE TIMES THE OUTPUT!", says Gar Wood Industries, Inc., of their new Mona-Matic installation. Output has increased, on turning these worm shafts, from 2 pieces formerly put on the floor every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds —one man operating two machines in each case. That's more than a 255% production increase for the Mona-Matics!

There's a great performance story here, too. Only a machine built like the Mona-Matic can deliver satisfactory finish and good tool life while maintaining required limits on the intermittent cut over the forged worm threads. The 2-speed motor on Machine #1 easily accommodates the turning of diameters as varied as those of worm threads and shaft end. Excessive stock removal from small end diameter is accomplished by dual template control on Machine #2. With two tools on rear slide of each machine, one faces the end of the shaft while one rough faces a shoulder and forms an undercut.

Here's a machine that can boost output and cut costs on long runs and short ones. Why not find out —right now—what it can do for you? Write for Booklet 1805 containing full information, data, job reports. It's new! . . . *The Monarch Machine Tool Company, Sidney, Ohio.*





Part—Worm Shaft. **Material**—SAE 8640 forging. **Operation**—turn complete for grind using carbide tools. Limits ± .001". **Comment**—with one operator for two machines in each case, output has soared from 2 pieces every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds—a 72% reduction in machining!

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

NEW HF INDUCTION HEATING GENERATOR

PUTS FULL POWER INTO A WIDER VARIETY OF LOADS

Westinghouse now presents a new high-frequency generator with 25 KW output at 100% duty cycle. For optimum performance, the new 25 KW has a tank kva of 1620. This means you can now put full power into a wider variety of loads . . . even where close coil coupling is impractical. Non-ferrous materials, like brass, copper and aluminum, can be heated in much shorter time. You benefit in higher production rates at lower costs.

This latest addition to the Westinghouse line of induction heating tools has many more outstanding benefits. Here are some of them:

- Allows positive, precise heat control of short production runs on a variety of jobs . . . or long production runs with rapid heat cycles. The built-in electronic keying of power output that makes this possible also eliminates main contactor arcing.
- Provides smooth variation of power output from 25% to 100%. This simplified power output system utilizes dependable, maintenance-free saturable reactors and longer-life, cost-cutting diode rectifier tubes.
- Gives complete protection against condensation and water impurity troubles. The built-in distilled water cooling system and heat exchanger offers substantial raw water economy, too.
- Assures long tube life, peak performance and minimum maintenance by close regulation of filament voltages.
- Offers easy inspection and maintenance through the full-opening double doors; easier operation through a simplified combination of conveniently located controls.

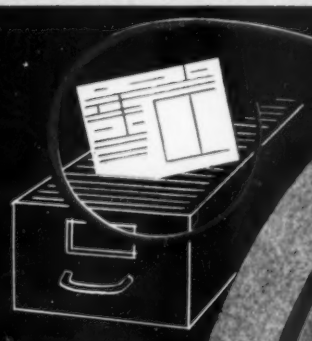
The new Westinghouse 25 KW RF Generator is available now in this de luxe model. A standard model is also available with electronic keying and smooth power output control features as easily-installed optional accessories. Both models offer flexible, economical handling of hardening, annealing and metals-joining jobs. For full information write: Westinghouse Electric Corporation, Electronics Division, Induction Heating Section, 2519 Wilkens Avenue, Baltimore 3, Maryland.

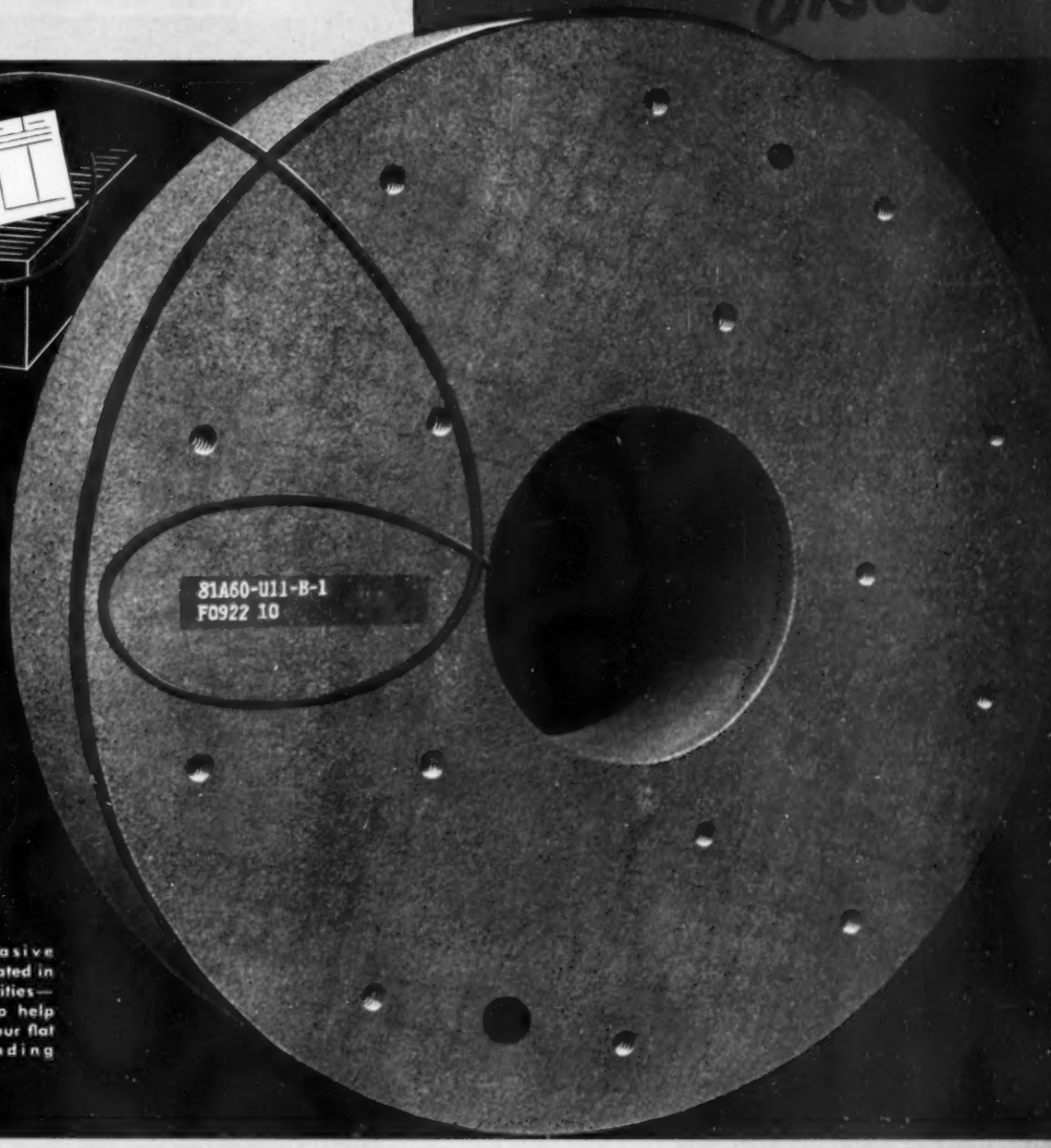
YOU CAN BE SURE...IF IT'S **Westinghouse**

J-02270

Customized Abrasive Discs Fitted To Your Grinding Needs

GARDNER abrasive discs





Gardner Abrasive Engineers—located in all principal cities—will be glad to help you with all your flat surface grinding problems.

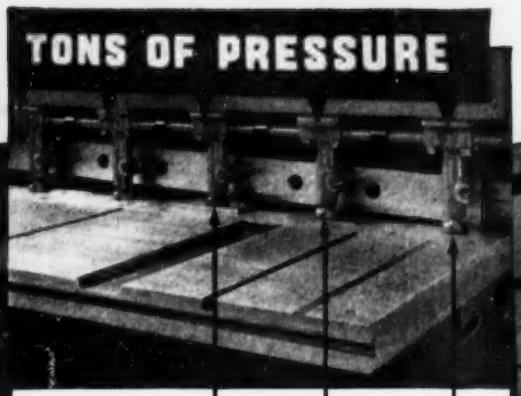
Send for Gardner Abrasive Disc Guidebook for better surface grinding results.

Gardner varies abrasive type, grain size and structure until you get the *best* abrasive to meet your job requirements. You get a Gardner Customized Abrasive that meets your needs for production, stock removal, finish, tolerance. Once your specific formulation is determined, the card record goes into our permanent file. Grinding results on reorders will be duplicated because your specific abrasive formulation has been duplicated. 109 A

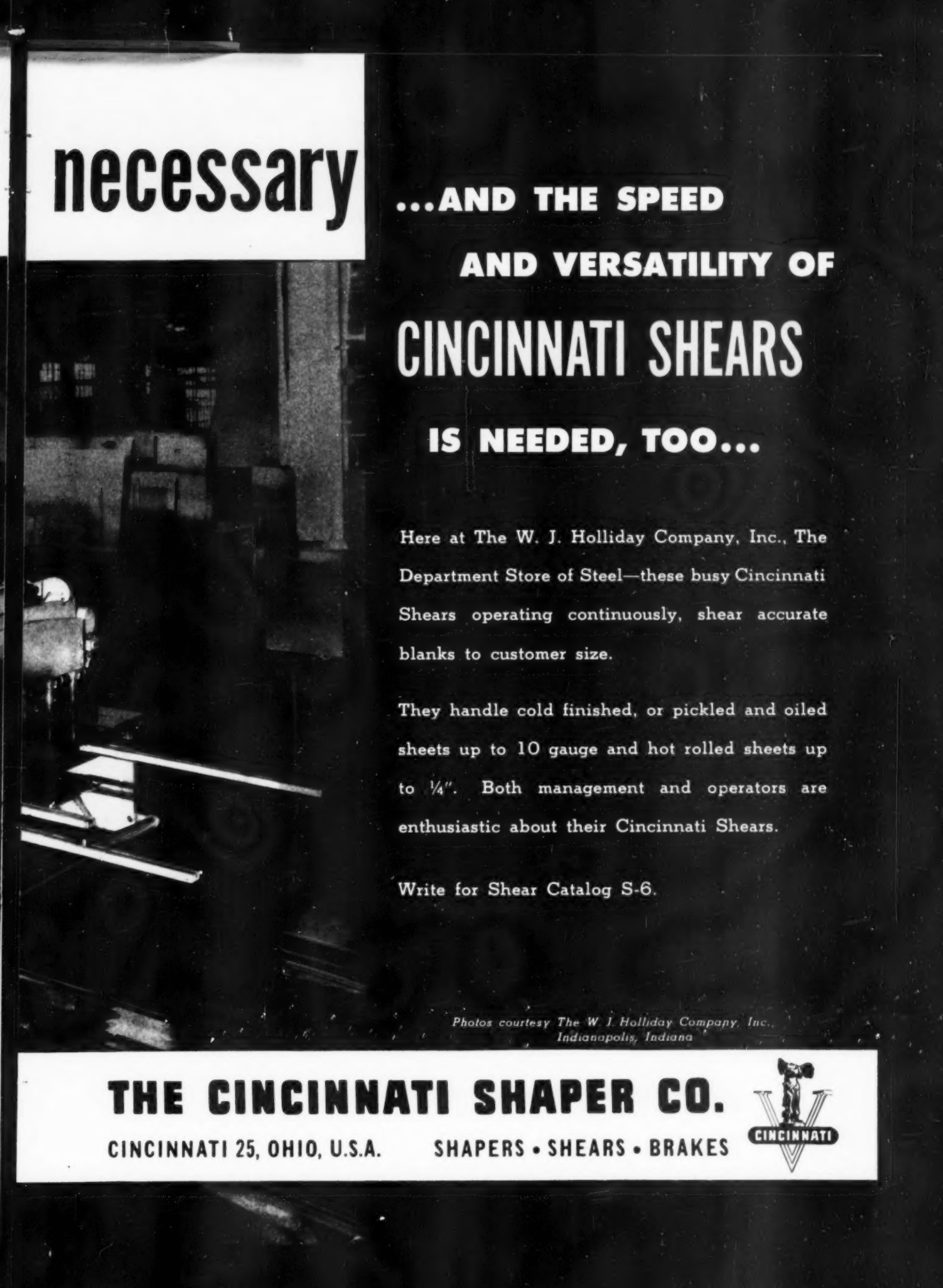
GARDNER MACHINE COMPANY

410 Gardner Street · Beloit, Wisconsin, U.S.A.

ACCURACY is



Micrometer accuracy starts with Cincinnati Hydraulic Holddowns. They exert tons of pressure and automatically hold all thicknesses of work securely.



necessary

...AND THE SPEED AND VERSATILITY OF CINCINNATI SHEARS IS NEEDED, TOO...

Here at The W. J. Holliday Company, Inc., The Department Store of Steel—these busy Cincinnati Shears operating continuously, shear accurate blanks to customer size.

They handle cold finished, or pickled and oiled sheets up to 10 gauge and hot rolled sheets up to ¼". Both management and operators are enthusiastic about their Cincinnati Shears.

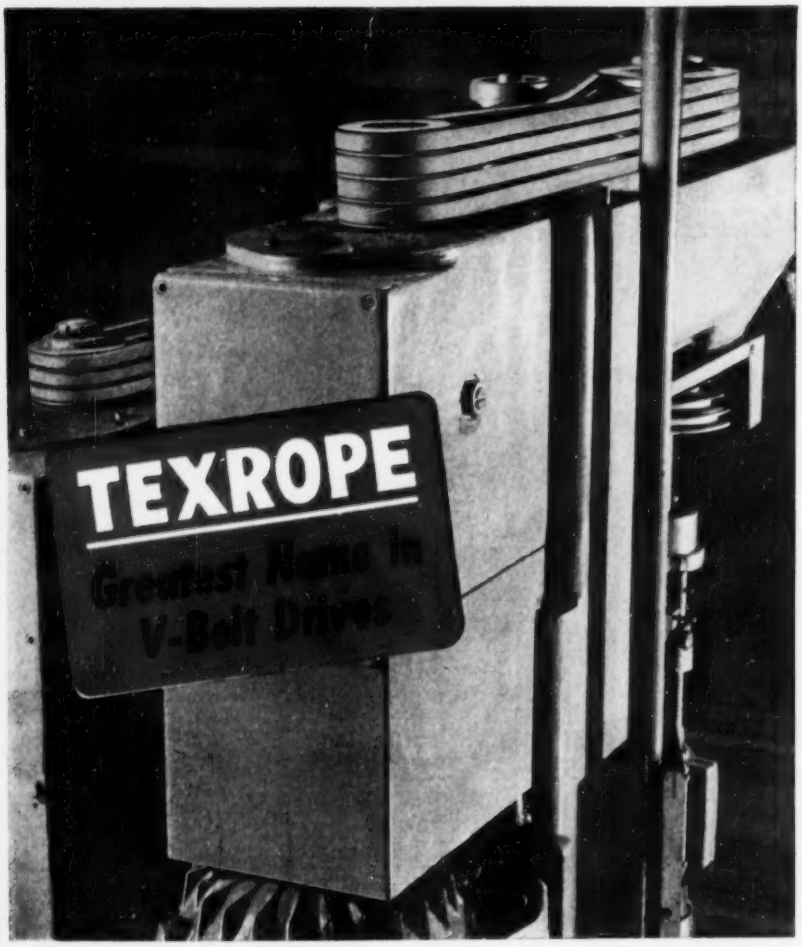
Write for Shear Catalog S-6.

Photos courtesy The W. J. Holliday Company, Inc., Indianapolis, Indiana

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



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ALLIS-CHALMERS HAS BOTH the engineering experience and the drive equipment to lick the most unusual problems. Your special problems are carefully analyzed by a staff of experienced application engineers familiar with your industry. The result — the right drive for the job! Call your nearby Allis-Chalmers distributor or district office for help on your drive problems, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4087

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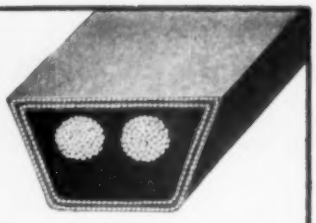
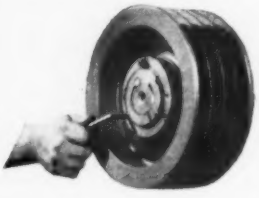


TEXROPE **Grommet V-Belts**—20 to 50% longer life than ordinary belts. Size for size, grommet belts give 1/3 more gripping power, pull heavier loads with higher safety factor.

STANDARD CAST IRON SHEAVES — Made to order from stock patterns. One to 14 grooves for A, B, C, D or E belts. One to 1000 horsepower. Split sheave or split hub.



MAGIC-GRIP **SHEAVES** — Semi-steel casting with interchangeable, patented taper bushings. On and off in a jiffy. Cannot shake loose. Two to 12 grooves for B, C and D belts; 2 to 250 hp.

Sold . . .

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MOTORS — ½ to 25,000 hp and up. All types.

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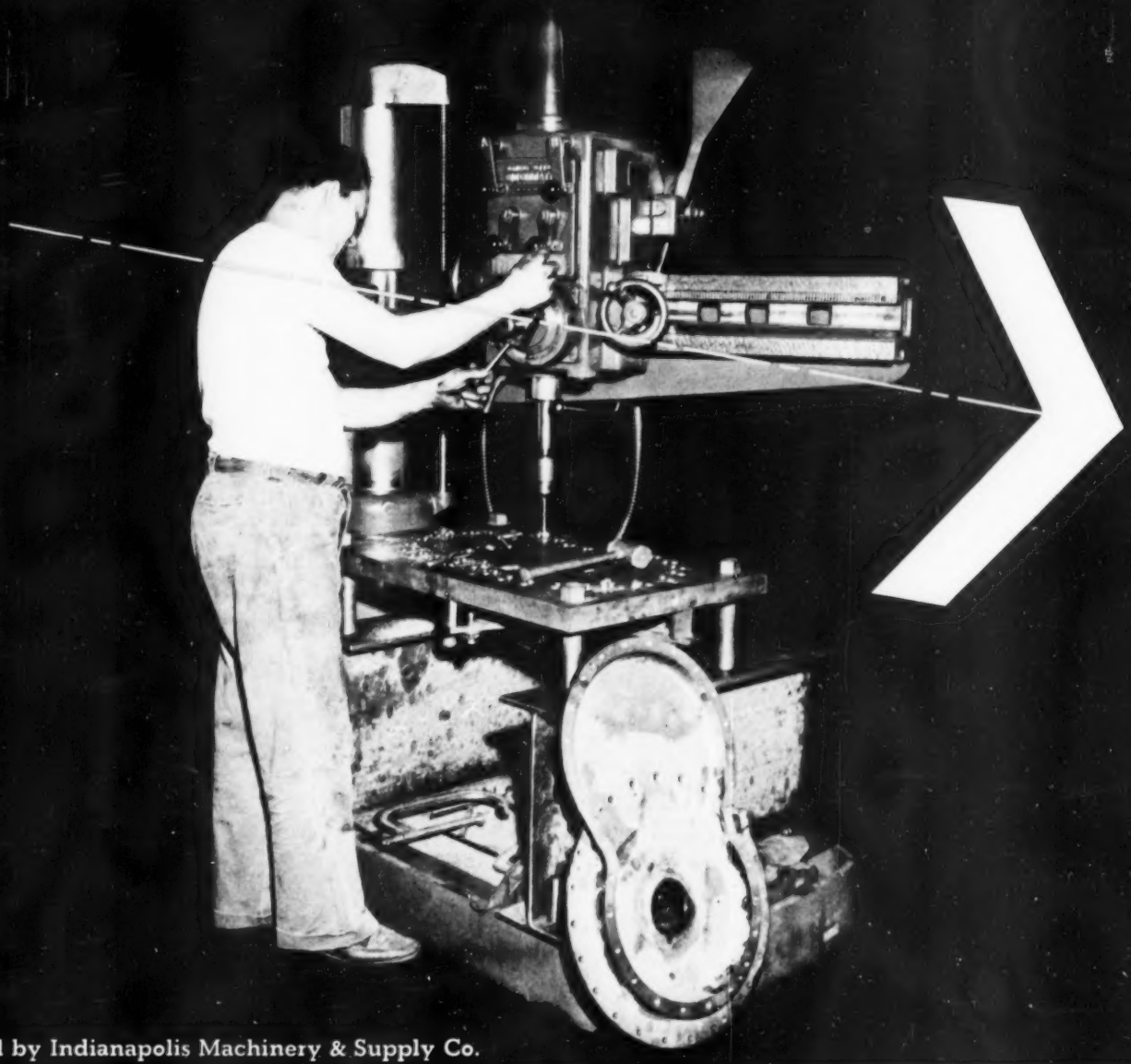

Installed by Indianapolis Machinery & Supply Co.

Drilling and tapping cast iron tank transmission parts at Dickey & Sons, Inc., Indianapolis, Indiana, one of the many job shops whose Cincinnati 3'7" Radials have "paid off" very quickly, as proven by careful record-keeping. This radial has a high "earning rate per square foot of floor space" because 1) it's inexpensive, and 2) a lot of work falls within its 1-inch capacity.
Your Cincinnati representative will gladly arrange a demonstration.

best buys in their class!

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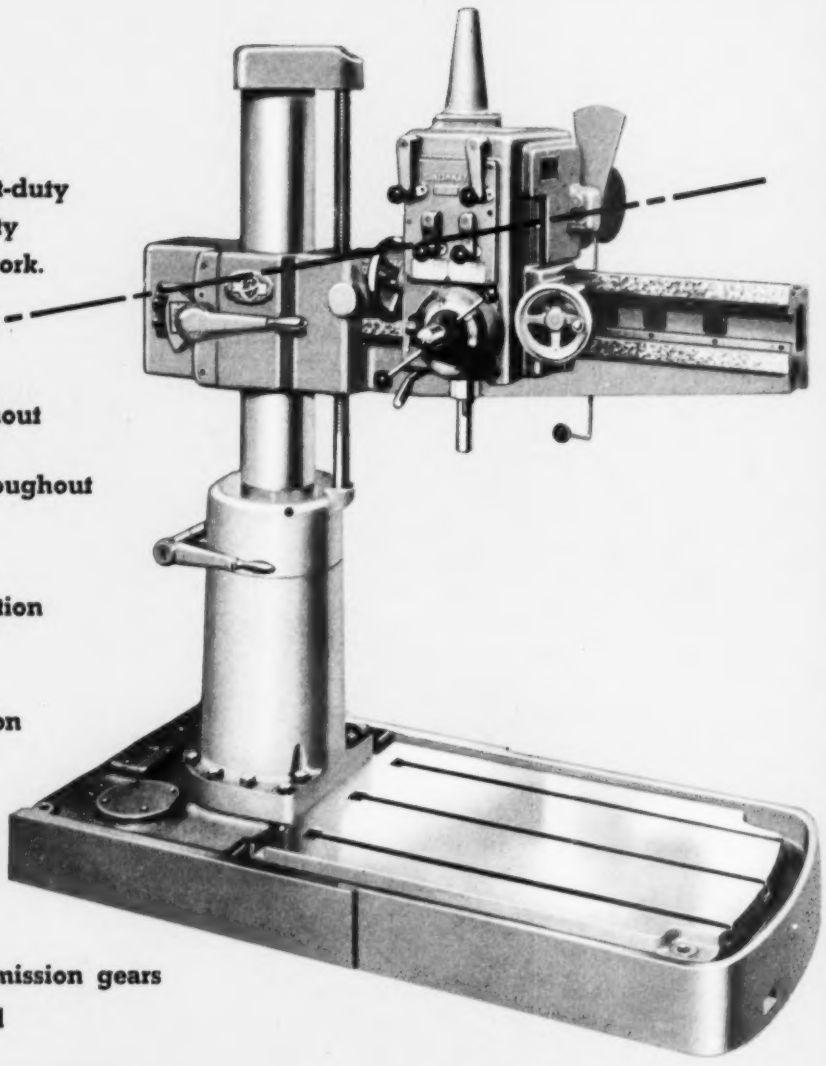
CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

MORE WORK / DOLLAR

Cincinnati 3'7" radials are truly economy-priced light-duty machines whose 1" capacity handles a wide range of work.



Unit construction throughout

Anti-friction bearings throughout

All geared head
with automatic lubrication

9 spindle speeds
in geometric progression
30 to 1 overall ratio

6 power feeds

Simple direct drive

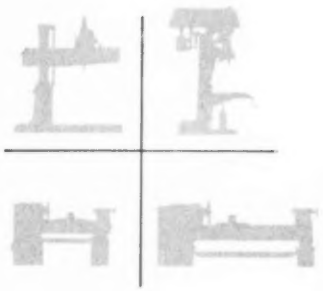
All speed and feed transmission gears
of alloy steel, hardened

This cost-saving radial is just one of the complete balanced line of Cintidrills, including 21" sliding head box and round column floor drills; 14" 3000 and 16" 3000 sliding head bench and floor drills; 16" and 18" Royal Cintidrills, bench and floor models, single and multiple spindles. Write for catalogs and name of your nearest dealer.

best buys in their class!

CINTIDRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.



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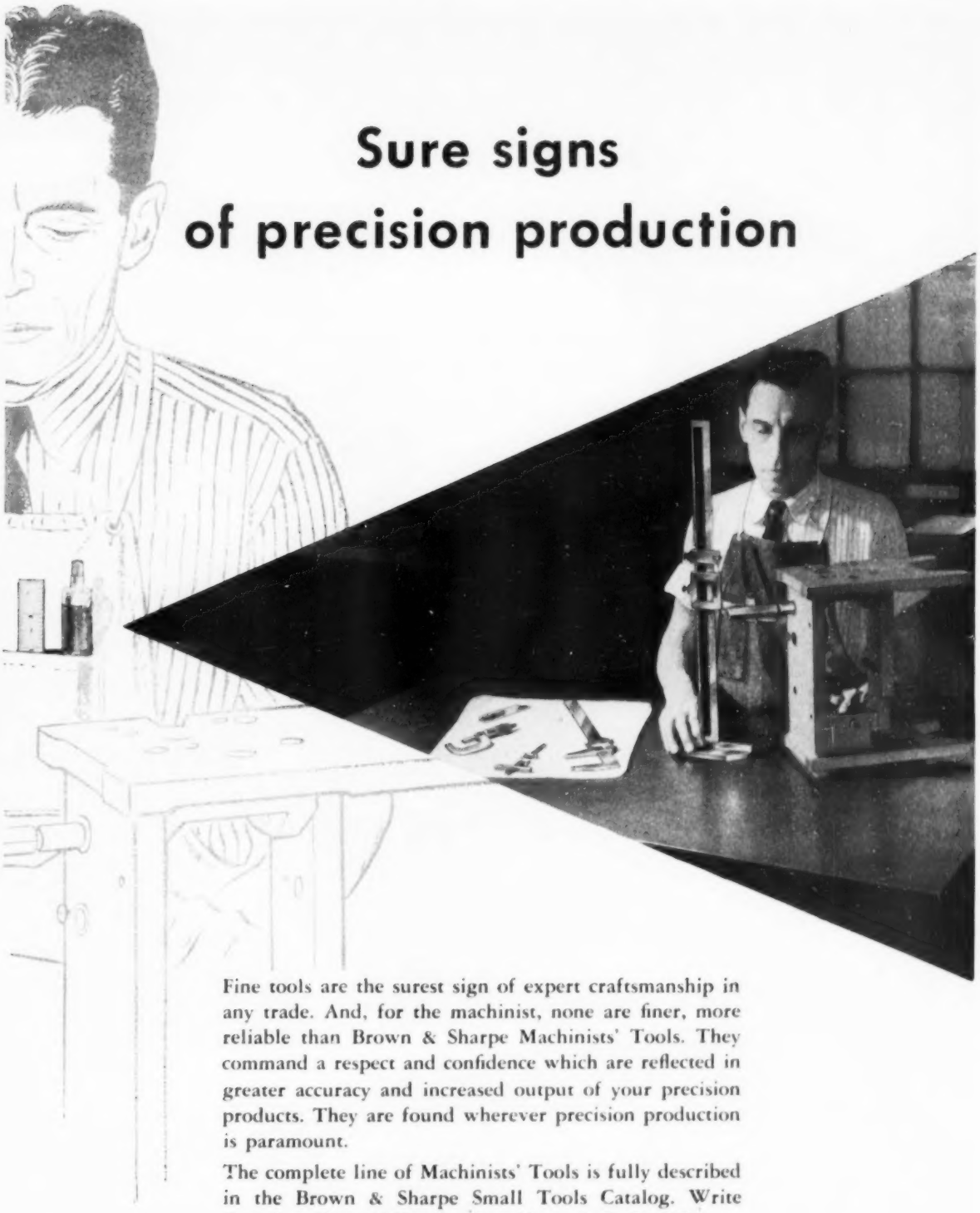
Sure signs of precision production



Fine tools are the surest sign of expert craftsmanship in any trade. And, for the machinist, none are finer, more reliable than Brown & Sharpe Machinists' Tools. They command a respect and confidence which are reflected in greater accuracy and increased output of your precision products. They are found wherever precision production is paramount.

The complete line of Machinists' Tools is fully described in the Brown & Sharpe Small Tools Catalog. Write Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Buy through your local Distributor

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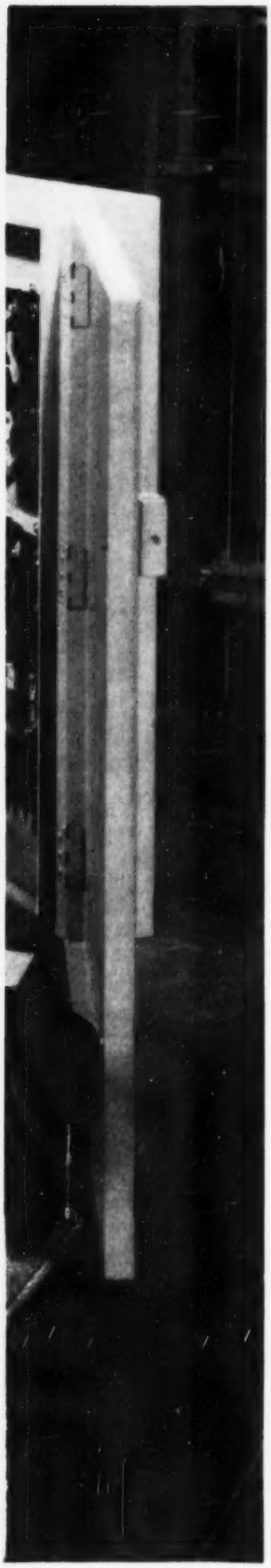


Build the best control panels your machines ever had

Match the proved protection of Westinghouse AB Circuit Breakers with the rugged dependability of Westinghouse Motor Control

For control panels that work harder, longer, more accurately and with less attention, look to Westinghouse. It can be your complete supplier of control components.

Westinghouse AB Circuit Breakers have been for years the world's standard in circuit protection. They are ideal for the hard service of machine control panels. Rugged, compact, completely dependable, they require no maintenance—save mounting space.

Westinghouse Motor Control is the new standard of control performance. Two of the many exclusive design features of Westinghouse Life-Line Starters assure maximum dependability over millions of operations:

1. Knife-edge bearing of specially hardened steel. Life-Line's only moving element "seesaws" on this bearing. It's friction free—can't stick or jam—will not operate falsely due to vibration or impact.
2. Snap-action bimetallic overload relay. Retains precise calibration—can't age, fatigue, oxidize. Will not fail if reset when hot.

In addition, Life-Line Starters are easy to mount and wire—save space, too. They are rugged—resist rough handling. And all parts are front-removable for top accessibility.

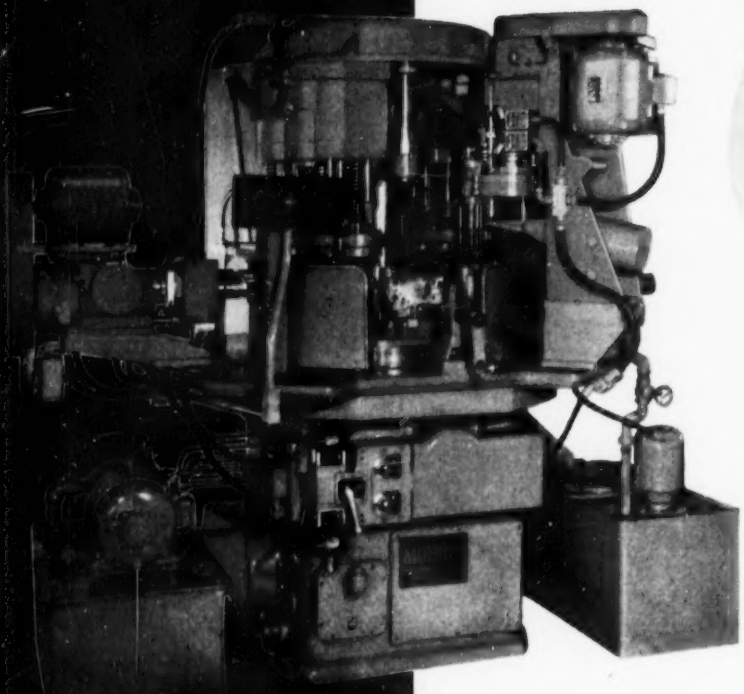
Get the best panels your machines ever had—get the outstanding advantages of both Westinghouse Circuit Breakers and Motor Control. Call your Westinghouse Representative for design data or application assistance, or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30157

YOU CAN BE SURE... IF IT'S

Westinghouse

how little does it cost...

to get "special machine" production with combination standard units?



Producing 170 finished transmission control valve bodies per hour at 100% efficiency, this machine performs 32 drilling and tapping operations in two cycles.

Here's a typical MOR-SPEED answer to an ever-more important problem:

A combination of Morris standard units . . . center column, base, indexing mechanism and hydraulic units . . . plus a made-to-order vertical and auxiliary side heads . . . make up this high production machine. Cost is less, delivery faster . . . the user gets the accuracy and low cost production of a "special" without the usual sky-high costs and limited application of conventional units.

Consider the multiple savings . . . investment, labor, time and floor space . . . of MOR-SPEED multiple machining. Let Morris Engineers prove that high production *and* precision can be yours for less than you might imagine.

a better product at less cost with precision - plus production

Builders of MOR-SPEED Tools

Morris

THE MORRIS MACHINE TOOL CO.

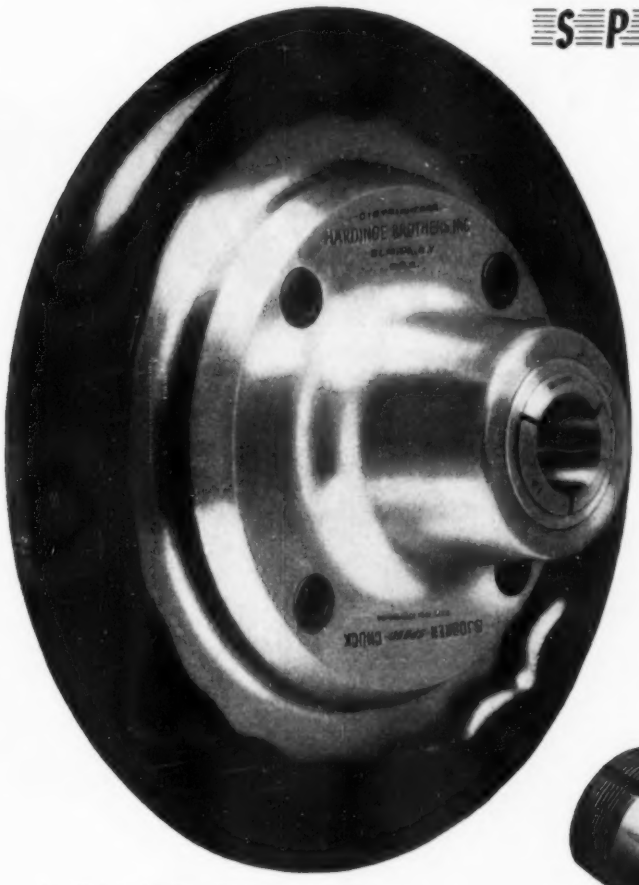
933 HARRIET ST., CINCINNATI 3, OHIO

HARDINGE-SJOGREN

HARDINGE
ELMIRA, N.Y.

SPEED

Collet Chucks with HARDINGE STEEL COLLETS



Available in Five Sizes:
1", 1⅜", 1¾", 2¼", and 3½" collet capacity.

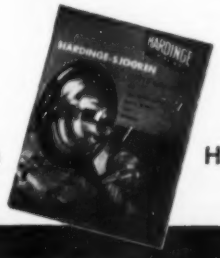
for Accuracy and Durability at Low Cost

When you order Hardinge-Sjogren Chucks and Hardinge **Steel** Collets you get all these advantages:

1. Complete Capacity for Hexagon and Square as well as Round.
2. Lowest Initial Cost.
3. Longest Service Life.
4. Grips both **short** and long lengths properly.

. . . . . and HARDINGE tempered steel collets assure you of quick release, sustained accuracy and durability.

Write for Bulletin 8— complete information on



HARDINGE-SJOGREN Chucks and Collets.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

The NEW

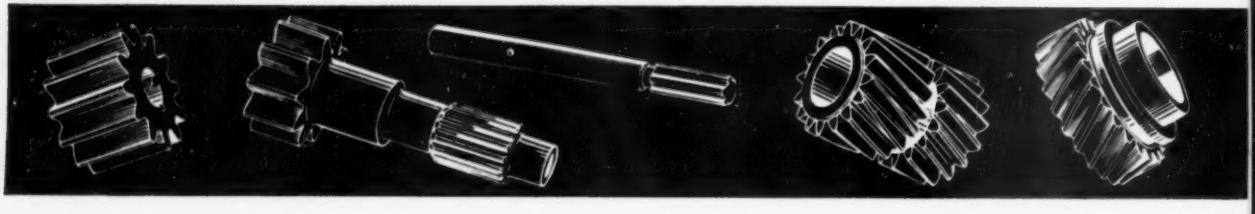
MODERN universal Burr-Master*

Model BME-14 Universal Burr-Master burrs and chamfers the complete tooth form on both sides and root as shown below.

The First Truly Universal Gear Burring and Chamfering Machine

At last, you can burr and chamfer the entire tooth form of both spur and helical gears from 5/8 to 9 1/2-inches pitch diameter, as well as external straight and involute form splines on the new Universal Burr-Master by Modern.

* Patents Pending



The new BME Universal Model Burr-Masters will solve your gear and spline deburring and chamfering problems at production rates heretofore impossible. Truly the answer to a normally costly gear and spline production operation, Modern's new Universal Burr-Master is . . .

universal . . because it doesn't sacrifice speed for versatility. Operating continuously, the machine deburrs and chamfers more than five teeth per second. A typical 22-tooth gear can be completely finished at a rate of more than 600 per hour, at 80% efficiency.

universal . . because new models have a capacity range from 5/8 to 6 1/2-inches pitch diameter and 3 to 9 1/2-inches pitch diameter for popular pitch gears. Both single and two-station models are offered for additional versatility.

universal . . because an unskilled operator can change the precision tooling for a different part in about 10 minutes setup time.

universal . . because it automatically compensates for minor stock variations in production parts. This unique design feature lets you deburr and chamfer gears or splines that are slightly oversize or out-of-round without affecting the operating cycle.

universal . . because all controls and adjustments are readily accessible when needed. No special tools required in making adjustments or changeover. All models developed for maximum production with minimum downtime.

universal . . because precision form-cutting tools can be removed, sharpened and replaced by an unskilled operator without worry as to gaging or alignment to retain correctness of form. Long tool life, too.

For complete details, write today for Bulletin 103-60

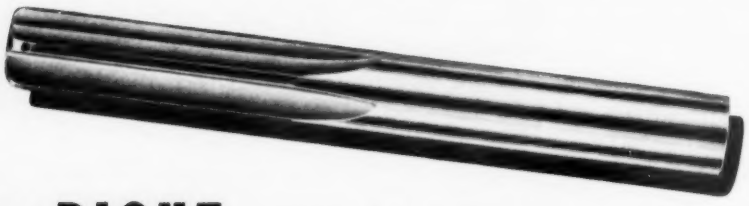
14230 BIRWOOD AVE. **MODERN** DETROIT 4, MICHIGAN

Industrial Engineering Co.

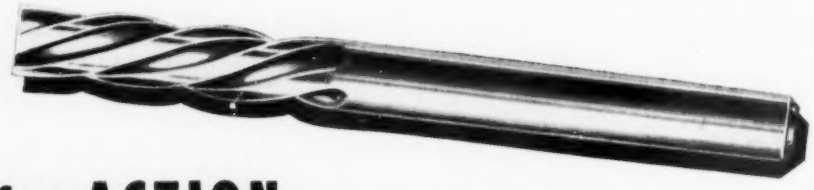
A T R A X

is for ATRAX . . . the finest of cutting tools.

is for TOUGH . . . they're *solid tungsten carbide.*



is for RIGHT . . . they're precision ground-from-the-solid.



is for ACTION . . . when Atrax tools solve difficulties in your production line.

is for X-TRAS . . . Atrax tools give with longer service, less trouble, better profits.

Representatives and Distributors in principal cities in United States and Canada. Write for name of representative in your area.

Send for complete catalog NOW!

THE ATRAX COMPANY

NEWINGTON 11, CONNECTICUT

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.

This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defence items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

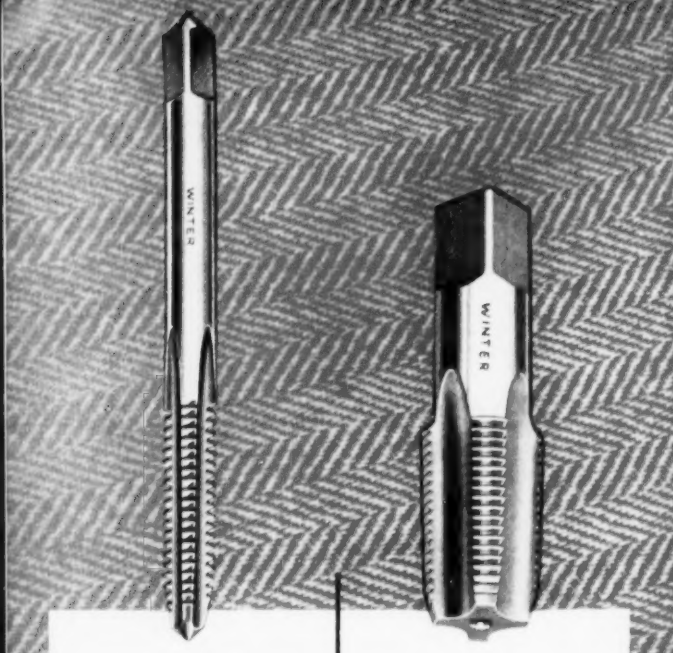
LATHES AND RADIAL DRILLS

Lowering the Cost of Tapped Holes: THE PRINCIPLE OF BALANCED *Action*

It saves money by giving you consistently accurate work, *minimizing scrap losses.* It saves money by giving you *longer tool life.*

WINTER BROTHERS COMPANY
Rochester, Mich., U.S.A.

Distributors in principal cities. Branches in New York, Detroit, Chicago, Dallas, San Francisco. Division of National Twist Drill & Tool Co.

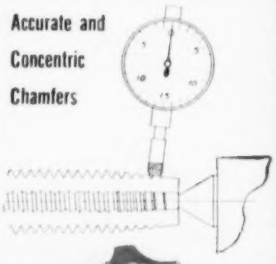


Exact Flute Spacing

Uniform Flute Contours

Precision Chip Driver Contours

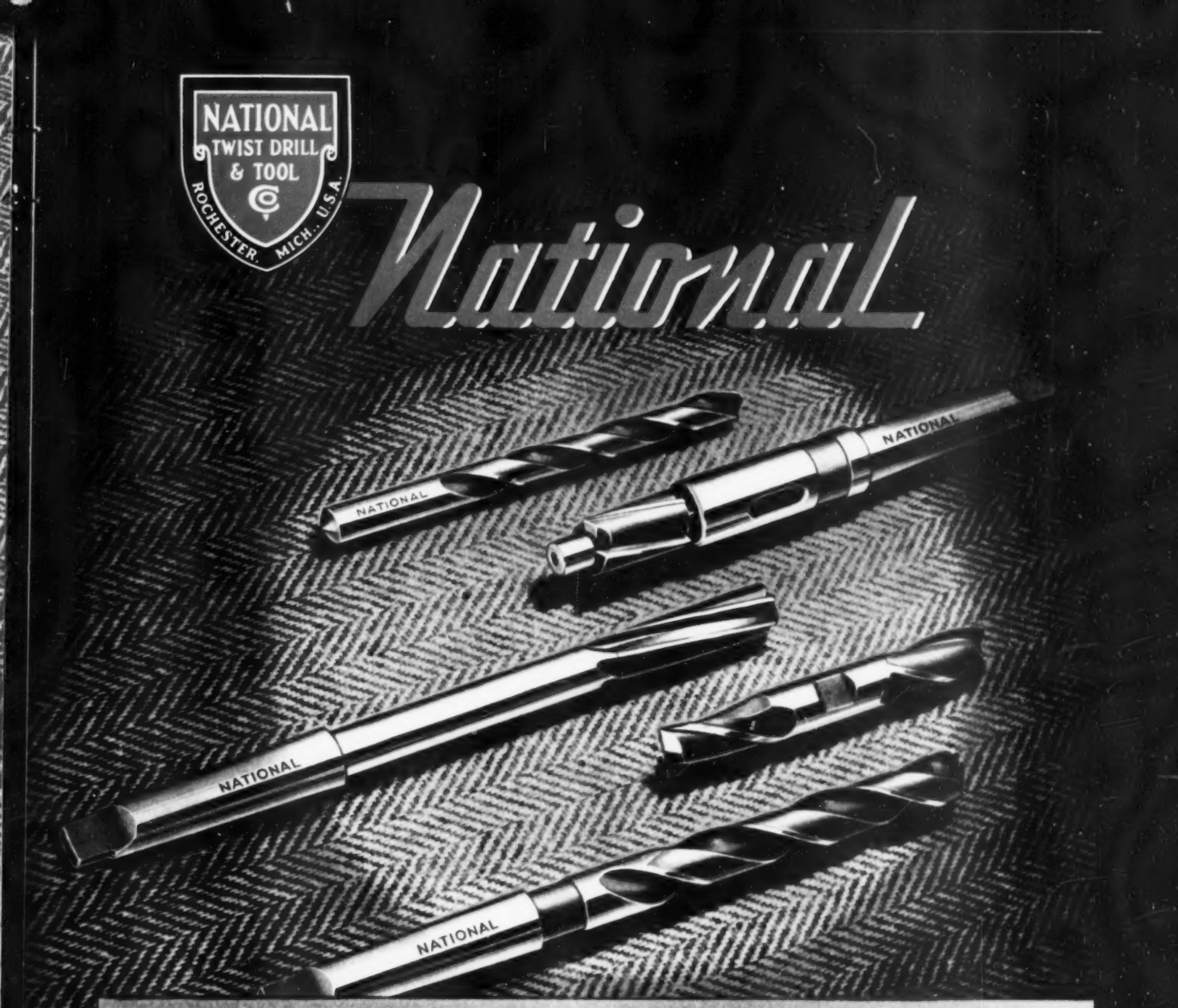
Accurate and Concentric Chamfers



ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.

WINTER



Today . . . Expect To Cut Metals at Lower Cost

YOU CAN—WHEN YOU HAVE CUTTING-EDGES LIKE THESE

It's the cutting-edge that counts. Cutting tools today, as National designs and manufactures them, will produce more pieces at lower cost. National gives you the edge!

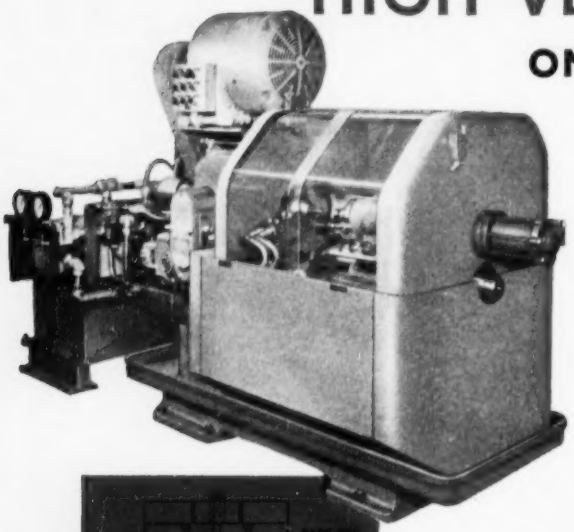
NATIONAL TWIST DRILL AND TOOL COMPANY
Rochester, Mich., U.S.A.

Distributors in principal cities. Factory Branches: New York, Detroit, Chicago, Dallas, San Francisco

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

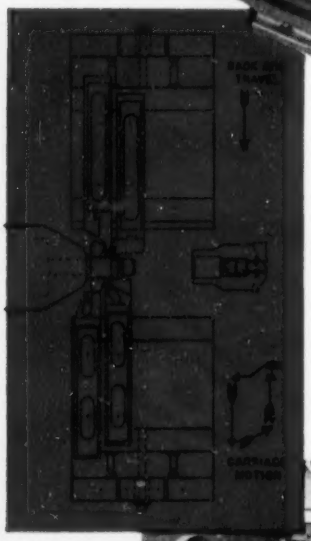
. . . for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs, and Special Tools.

AUTOMATICITY BACKS UP HIGH VELOCITY TURNING ON FAY AUTOMATICS



SIDE GEARS
18 Seconds Floor to Floor — 635 SFM

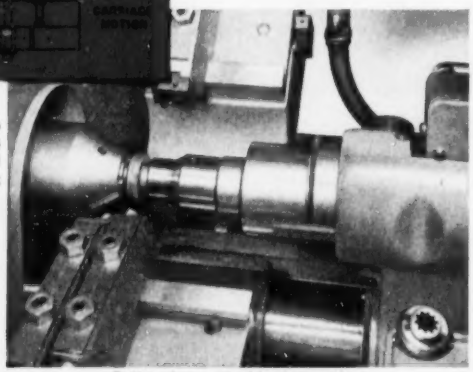
Two 8" Fays, with Automatic Sequential Control, machine all exterior surfaces of the blanks in two operations; one machine for each. The major diameter is 2-15/16" and floor to floor time is approximately 18 seconds in each operation.



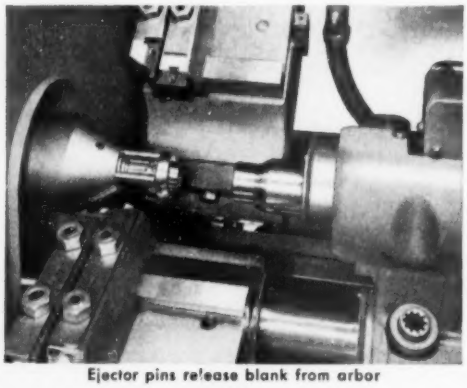
FIRST OPERATION: Note intricate movements of the carriage, which turns the hub, back angle and major diameter. The back arm faces and forms.

Automatic Cycle—The machines are equipped with automatically operated splash guards and automatically air-operated tailstock rams for pressing the blank onto a splined arbor equipped with automatically operated ejector pins.

The operator places the blank on the end of the arbor, and pushes the cycle start button. *Automatically, the guard closes, the tailstock ram presses the piece onto the arbor and then retracts. The carriage turns, the back arm faces, and at the end of the cuts, ejector pins push the piece onto the loading section of the arbor* from which it is removed manually.



Tailstock presses blank on arbor



Ejector pins release blank from arbor

Production management regularly relies upon the engineering services of Jones & Lamson for the latest information on methods, costs, tooling and performance. Why not consult us about YOUR *turning, threading and inspection problems.*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

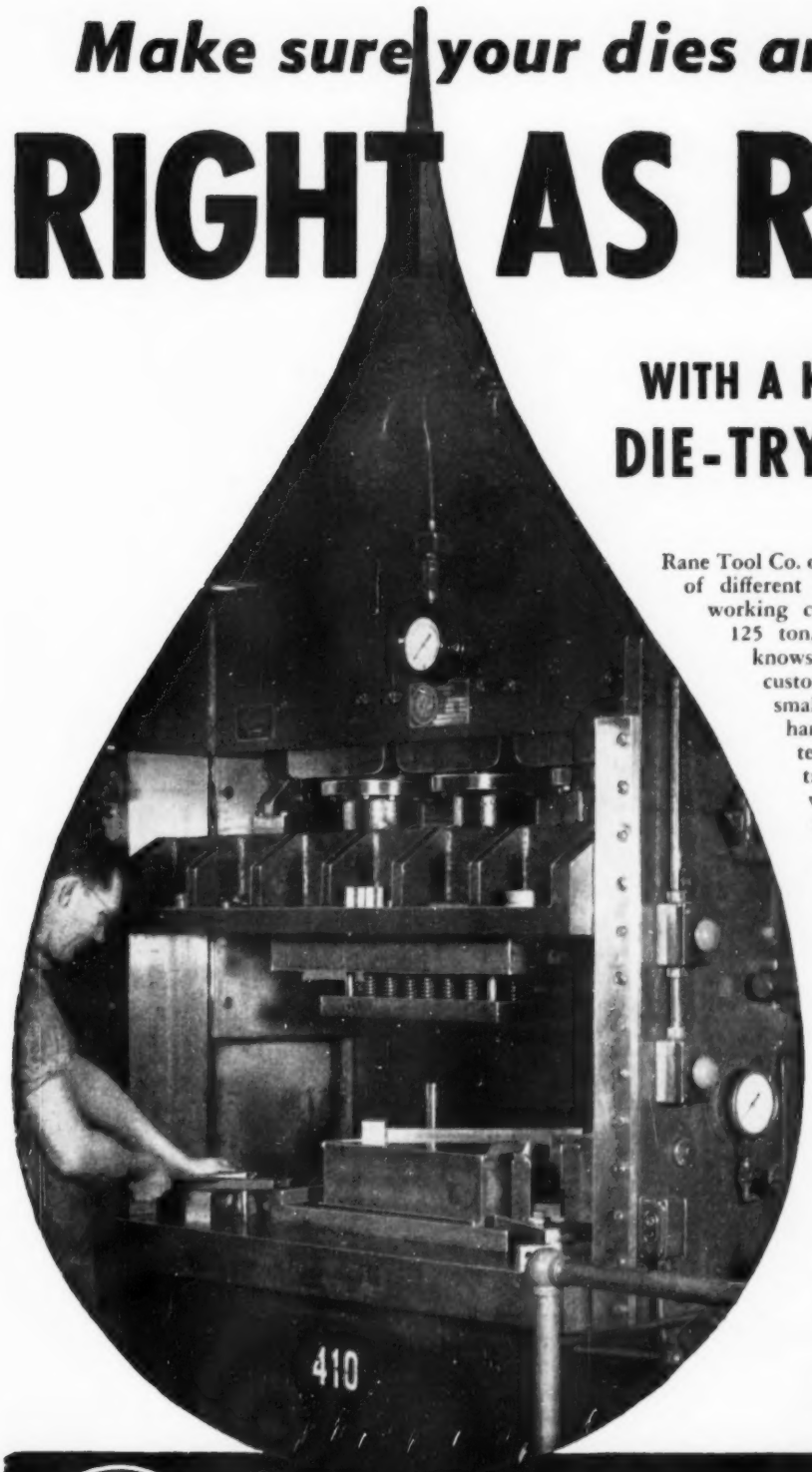
JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

FAY LATHE DIVISION

Make sure your dies are always

RIGHT AS RANE!

WITH A KRW HYDRAULIC DIE-TRYOUT PRESS!



Rane Tool Co. of Jamestown, N. Y., makes hundreds of different dies for America's leading metal-working companies. Thanks to their KRW 125 ton, 3-cylinder Hydraulic press, Rane knows their dies will work perfectly in the customer's plant. Some Rane dies are small enough to fit in the palm of your hand; others are big babies that take ten men to lift. And all of them are tried out on this KRW press. It's working 95% of every day. And the Rane people tell us it's the most versatile piece of equipment in their shop.

Whether die-making itself is your business, or whether you make dies for your own production use, a KRW die-tryout Hydraulic press will soon pay for itself in time and money saved. With a KRW press in your machine shop you *know* dies will work in production before they leave the shop. There's a KRW Hydraulic press to meet any metalworking problem. 25 - 150 ton capacities, all self-contained above ground; one, two and three cylinder models; hand operated, air operated or motor driven.

Maximum size Bed and Platen on 100 and 125 ton models—40" x 60"; on 150 ton models—36" x 60".

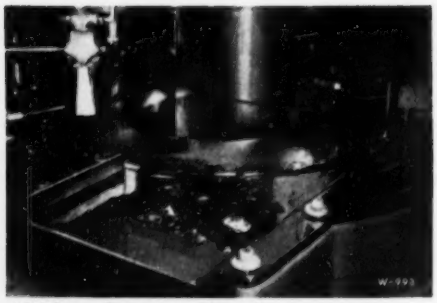
Ask your machinery dealer to quote you or write, wire or phone Dept. 11, for full facts, prices and delivery dates.

SINCE 1916 KRW A MARK OF DEPENDABILITY

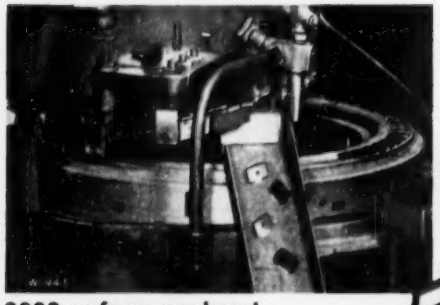
K·R·WILSON

Designers and builders of hydraulic presses to meet any metal working problem

215 MAIN STREET · BUFFALO 2, N. Y.

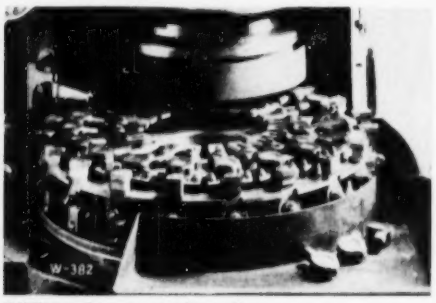


4360 surfaces per hour!



2000 surfaces per hour!

940 surfaces per hour!



900 surfaces per hour!

1400 surfaces per hour!

FIELD REPORT:

... a Blanchard No. 16-A Surface Grinder saved them $39,000 in 2½ years! (cost approx. $12,500) Their order follows for a Blanchard No. 16-A2!

Here's proof of performance and proof of satisfaction, yet typical of what users expect *and get* from the Blanchard 16-A Surface Grinder. Several typical examples of production rates are shown here. Above, for instance, .003" of stock is being removed from one side of small gears to a tolerance of ±.001" *at a rate of 2100 per hour!* This machine has a 30" chuck and a Blanchard Demagnetizer.

The No. 16-A grinds continuously with a wheel that is set and automatically maintained at a fixed height above chuck face, and finishes one surface of the work to size in one pass under wheel. Operator has only to load the work on the magnetic chuck or in an automatic clamping fixture. A wheel control automatically feeds the head down to compensate for wheel wear. Unloading is usually automatic. Attachments can be supplied for demagnetizing and washing the work as it leaves the grinder. On most work, limits of ±.0005" are readily maintained.

The No. 16-A2 (not shown) has two wheels, each with automatic size control. It roughs and finishes one surface of the work in one pass through the machine.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE CO.

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

Do you need the solution to a tough, high-production metal-working problem?

If you do, Kearney & Trecker's Special Machinery Division has the "know-how" and capacity to design and build the special equipment you need

SINCE 1898 Kearney & Trecker has been aiding the metalworking industries by overcoming production difficulties with special machines and tooling or adaptations of standard equipment.

Today, its Special Machinery Division is in a better position than ever before to help you with your problems. It has a new $5,000,000 plant to work in . . . and over $2,500,000 worth of new tools to work with. The Special Machinery Division is staffed by almost 100 design, project and production engineers plus a full complement of skilled machinists and floor men.

Take the first step now

Get in touch with your Kearney & Trecker representative or contact the factory. In response, one of our Senior Project Engineers will promptly visit you and make a field analysis of your requirements. There's no obligation, of course.

Our Customer Engineering Service takes over your production headaches

After all the facts have been gathered, a team of Project Men in our Customer Engineering Service will review the job. These widely-experienced, practical-minded men will check the work-piece itself . . . how to hold, machine and process it . . . and every other contributing factor. They'll develop preliminary sketches and get started on a proposal.

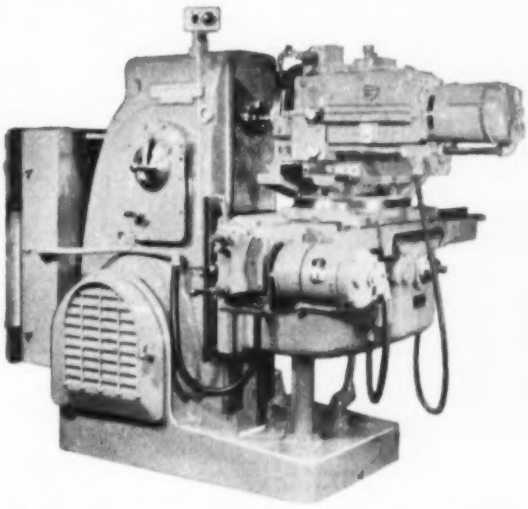
You get quality equipment, delivered when promised, carefully installed

As the Special Machinery Division is an integral part of the Kearney & Trecker Corporation, every product is fully supported by the entire organization's financial, physical and personnel resources. This means that, in addition to the machine or machines of exceptional quality that will solve your difficulties, you get delivery as promised plus fully supervised installation and followup service.

We invite your inquiry

We'll be glad to provide you with any information we can. This includes sample machine specification sheets on typical special machine installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 West National Ave., Milwaukee 14, Wisconsin.



It is not always necessary to design a completely new machine. Here's an example where a standard milling machine column has been fitted with a specially designed fixture. Its job — to produce face, plate and barrel cams of differing sizes.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

TYPE HG is primarily designed for hardening of carbon and alloy steels without scale or decarb when used with Endogas® atmospheres. Exogas® may be used to minimize scaling when decarb is not a factor. It can be used without atmosphere.

FOR YOUR TOOLROOM Box Type H furnaces are designed for application where batch production is possible and where a protective atmosphere is not required. They have an operating temperature range from 1200°F. to 1850°F. Safe loading capacity at 1600°F. is 180 lbs./sq. ft. of hearth area.

FOR YOUR LABORATORY Box Type B furnaces are designed for light or intermittent duty where protective atmosphere is not necessary. Short legs are furnished for bench mounting in laboratories. Automatic temperature control permits closely controlled heat-treating.

Get Westinghouse furnace flexibility ...for job-lot production problems

Westinghouse Box Type Furnaces are completely flexible and versatile in application. They may be utilized over a wide temperature range for annealing, preheating, hardening and tempering operations on tools and small parts. Brazing or other joining methods may be combined with heat-treating . . . done at the same time to give best results at vastly *LOWER PRODUCTION COSTS.*

Whether it be for your production line, toolroom or laboratory, you'll get the heat-treating flexibility and versatility you need and want at low costs with Westinghouse Box Type Furnaces. For more information use the coupon below, or contact your nearby Westinghouse Office. Westinghouse Electric Corporation, Industrial Heating Department, Meadville, Pennsylvania. J-10391

YOU CAN BE SURE...IF IT'S Westinghouse

Westinghouse Electric Corporation
Industrial Heating Department
Meadville, Pennsylvania

Please send me free booklet, *Westinghouse Furnaces for the Toolroom, Laboratory or Production Line.*

Name_____

Firm_____

Title_____

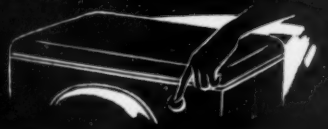
Address_____

How times have changed!

for instance:

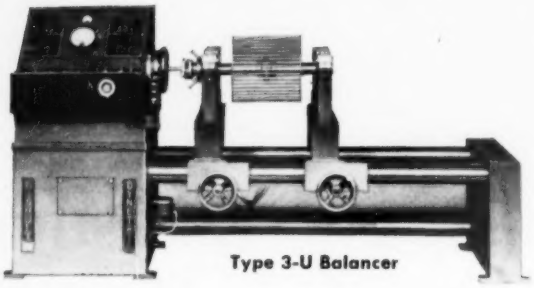
This was transportation . . . . **NOW** this is it.

This was the best cleaner . . . . until we got **THIS.**



The old rub-a-dub washdays . . . . gave way to **THIS.**

This was a balancer . . . . . . until we built **THIS!**



Type 3-U Balancer

Any job worth doing is worth doing *right!* And with today's precision manufacture and high-speed rotating parts, that applies to balancing more emphatically than ever.

If your work involves balancing, do it the *modern* way—with Gisholt DYNETRIC Balancing Machines. Here's unrivaled speed that enables you to locate and measure unbalance in a matter of seconds—unequalled accuracy, capable of detecting vibrations as small as .000025".

Gisholt Balancers are available for handling all kinds of rotating parts, from a fraction of an ounce to many tons. Write us for a copy of the booklet STATIC & DYNAMIC BALANCING.

DYNETRIC BALANCERS

GISHOLT

MACHINE COMPANY

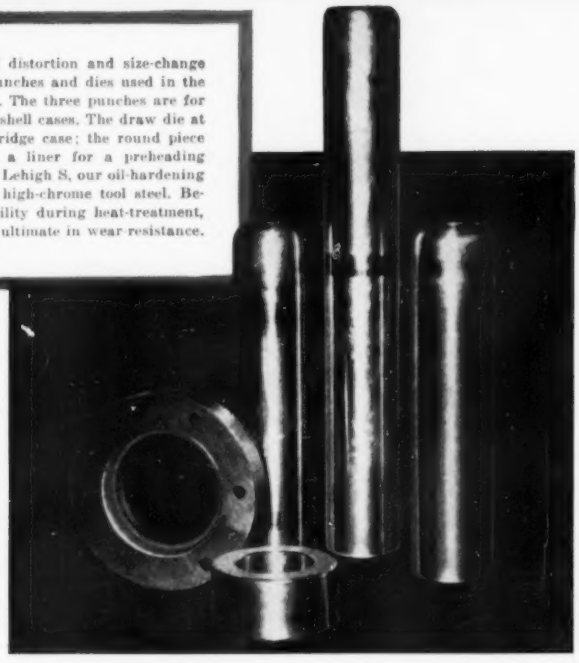
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Only the minimum of distortion and size-change can be tolerated on punches and dies used in the cold-extruding of steel. The three punches are for cold-drawing 105 mm shell cases. The draw die at left is for a 5-in. cartridge case; the round piece in the foreground is a liner for a preheading die. All are made from Lehigh S, our oil-hardening grade of high-carbon, high-chrome tool steel. Besides its inherent stability during heat-treatment, Lehigh S provides the ultimate in wear-resistance.

There's no such thing as a non-deforming tool steel

Shrinkage, growth, and warpage — all occur when a tool is heated for hardening. There just isn't a tool steel which is "non-deforming" in the absolute sense of the term.

It's downright discouraging when an accurately machined tool or die emerges from the heat-treating furnace with its shape distorted or its dimensions way beyond the allowable tolerances. Yet, this experience is quite common.

In many instances the change in size caused by heat-treatment is not so great as to cause any trouble. Proper grinding, to remove scale and to obtain exact tool dimensions, is often all that is necessary. However, excessive warpage or size change can make it costly, even impossible, to restore a tool to the proper shape or correct dimensions, either by grinding or by corrective heat-treatment.

It's obviously important for both toolmakers and heat-treaters to understand the causes of distortion and how it can be controlled within reasonable limits. The design of tools, the grade of tool steel used, and heat-treatment procedures — all these factors have a bearing on the degree of distortion which will occur.

Warpage, for example, is usually a factor associated with the geometrical shape of a tool and with the thermal stresses produced by lack of uniformity in heating or cooling operations. The composition of a tool steel has very little to do with the occurrence of warpage.

On the other hand, the growth or shrinkage of tools is the result of volume changes caused by the hardening operation. Each grade of steel has certain characteristics of inherent distortion. And it varies considerably with the composition. Carbon tool steel, for example, has a distortion "factor" of approximately .002 to .004 in. on the plus side. A high-carbon, high-chromium grade, such as our Lehigh H, has a factor of only .0005 in., plus or minus.

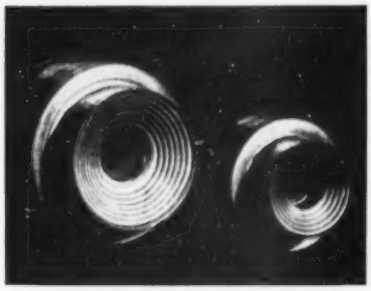
If you'd like a printed discussion of this subject write to our Publications Dept. at Bethlehem, Pa., for the booklet "Distortion of Tool Steels in Heat Treatment."

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Avoid drastic changes of section in tool design

You can expect trouble whenever a tool made of a liquid-quenched steel is designed so that heavy and light sections are adjacent. When such a tool is quenched, the light sections cool rapidly and harden before the adjacent heavy sections. Quenching stresses are set up which often exceed the strength of the steel. Cracking is the result.

Although such tools fail during heat-treatment, poor tool design must take the blame. Troubles of this sort are sometimes avoided by differential hardening or making this type of tool as a two-piece assembly. But if a one-piece construction is necessary, then it's best to use an air-hardening steel.



FOR TOOTHPASTE TUBES

These intricately machined dies are used in shaping the tapered neck and tip of toothpaste tubes which are extruded from round slugs of aluminum. When a punch is driven downward towards the die, the aluminum "biscuit" is trapped between the punch tip and the die and is extruded by the heavy pressure, flowing upwards along the cylindrical punch to form the tube body.

The dies pictured are made from our 67 Chisel tool steel, a chrome-tungsten grade of shock-resisting steel that's ideal for tools and dies requiring plenty of impact strength. Although it is principally a shock type of steel, 67 Chisel is readily carburized whenever extra wear-resistance is needed . . . without sacrificing the advantages of its tough core.

Easy to machine and heat-treat, 67 Chisel is stocked by distributors of Bethlehem tool steel in principal cities.

ARMSTRONG
TOOL HOLDERS

Equip with
ARMSTRONG TOOL HOLDERS
for Defense production

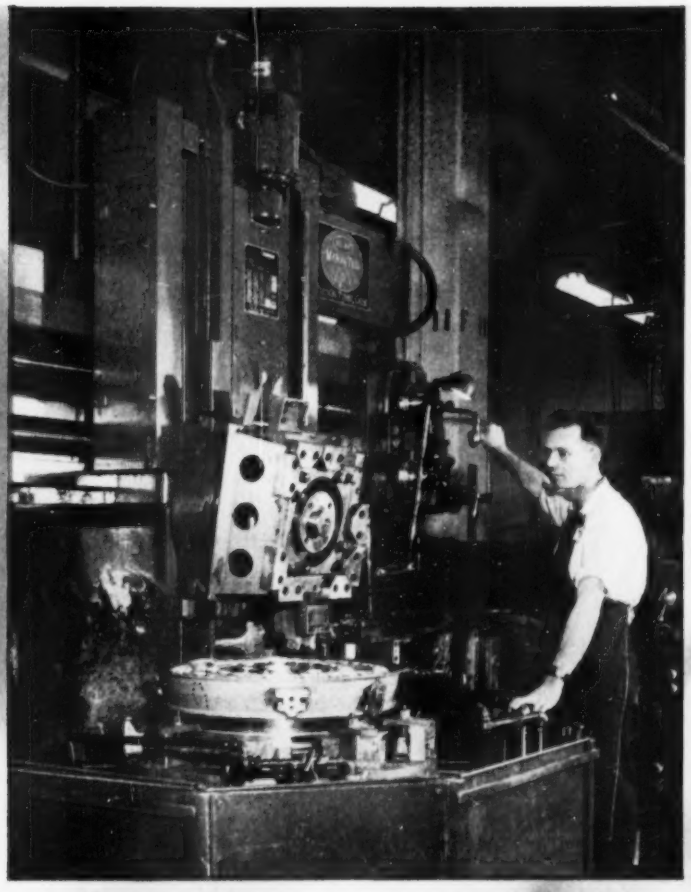
A change over to new products, starts in the tool room and the die shop . . . starts with ARMSTRONG TOOL HOLDERS. In preparing for defense orders, the logical first step is to check your stock of ARMSTRONG TOOL HOLDERS. With the correct types for every operation, and the correct sizes for each lathe, planer, slotter and shaper, you will be able to start work on a moments notice.

ARMSTRONG TOOL HOLDERS reduce "tooling-up" to the selection of a cutter and tightening of a set screw. They permit operation at higher speeds, and heavier feeds than are customary—they enable you to produce more pieces per hour, per man, per machine.

Produced by modern methods, in a specially-built tool plant, they are the lowest cost tooling you can buy. And, they are as available as your telephone for they are carried in stock by your local supply house.

Use ARMSTRONG TOOL HOLDERS wherever possible for lower tool cost, saving in High Speed Steel, increased output and greater profit. *Write for Catalog*

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"*
5213 W. ARMSTRONG AVENUE CHICAGO 30 ILL.



Pacemakers on the Jet PROGRAM

The inception of Man-Au-Trol Vertical Turret Lathe started a new manufacturing era in the boring mill field.

Man-Au-Trol manual or automatic control has taken the guess work out of previous manual operations on highly accurate repetitive work.

Automatic change of feeds and speeds at the proper instant, automatic change of direction of feed, automatic precision indexing of heads for succeeding operations — all contribute to the productive efficiency and minimum operator fatigue at a pace previously unobtainable in single spindle machines of the size and capacities of Man-Au-Trol.

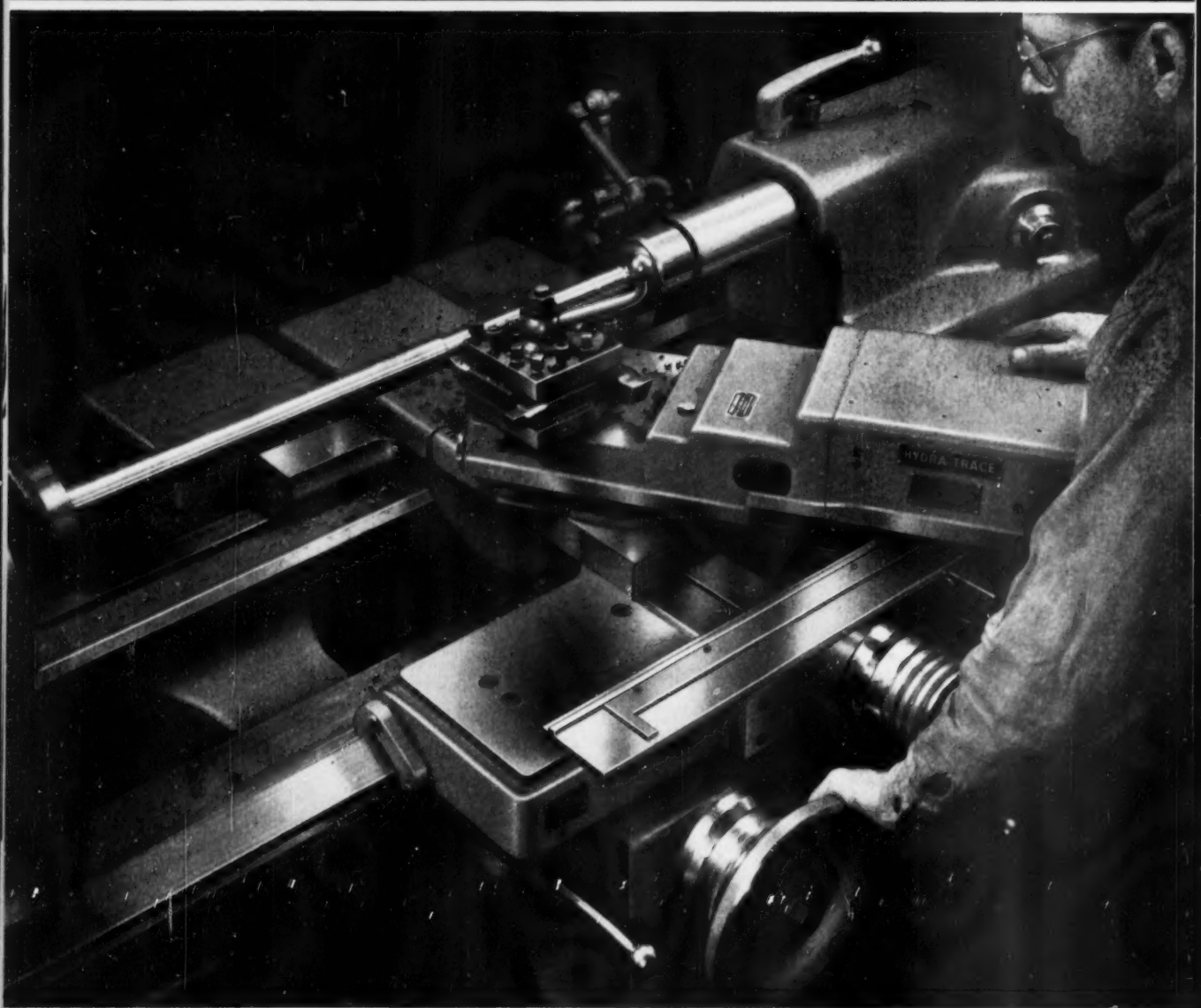
For "set-ups" or shorter run jobs, manual operation is quickly available without disturbing the settings for the automatic cycle.

Learn about the manufacturing efficiency of this machine as applied to your work.

THE BULLARD COMPANY
Bridgeport 2, Conn.

NOW SCULLY-JONES TURNS

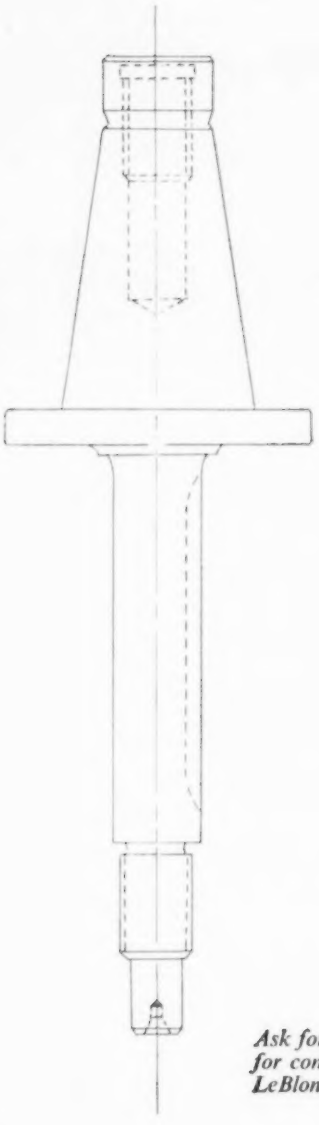
four arbors instead of 3...



Hydra-Trace (Trade Mark Registered U. S. Pat. Off.) is LeBlond's heavy-duty hydraulic tracing attachment can be mounted in place of the compound rest on practically all LeBlond Lathes built since 1935

same time, same lathe...

plus "Hydra-trace"



When defense needs mushroomed demand for production equipment, Scully-Jones & Co. of Chicago found itself jammed with orders for milling machine arbors (they make more arbors than anyone else). Acting on advice from engineers at LeBlond's Chicago Office, Scully-Jones added Hydra-Trace to their LeBlond 16" RT Engine Lathe. Now they turn out four arbors in the time formerly needed to produce three—same lathe, plus Hydra-Trace.

Besides boosting output, this template-controlled hydraulic tracer saves 45% on set-up time, gives uniform precision without the need of a highly-skilled operator.

Stepless form-turning, contour facing, and turning step shafts are all in a day's work for Hydra-Trace. *Fits all LeBlond Engine Lathes built since 1935*, can be mounted easily in a matter of minutes. Templates are flat, compact, suitable for both rough and finish turning. They can be produced readily in your own plant, stored in limited space.

When turning requirements call for increased output—with present machines or with new equipment—you'll find just what you need in LeBlond's complete line of lathes and lathe attachments.

Call your nearby LeBlond Distributor or write—

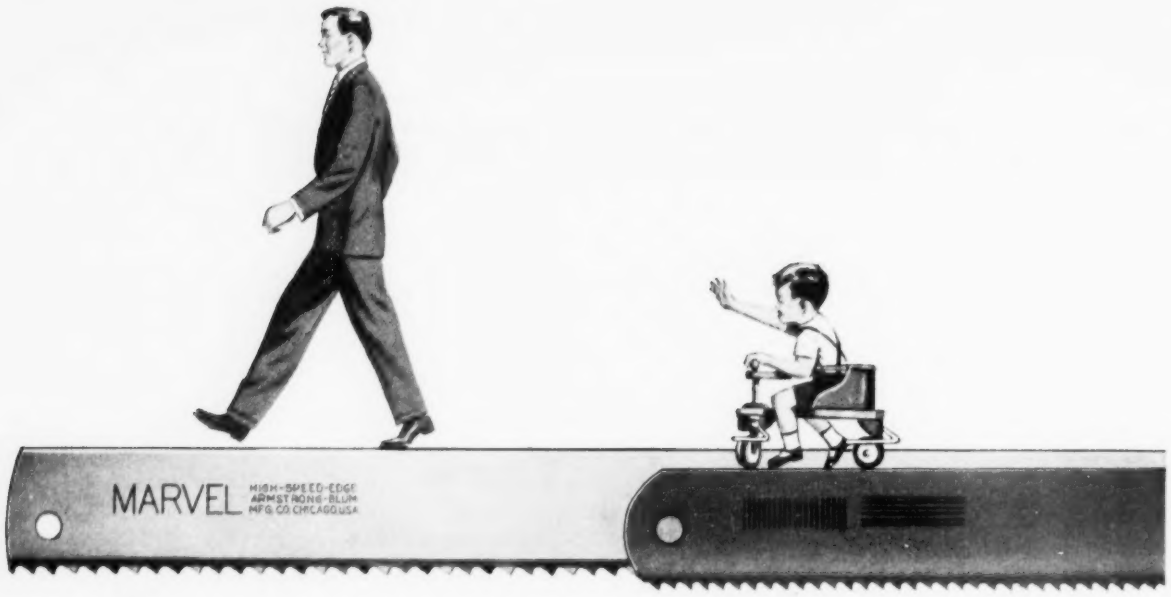
Ask for Bulletin HT2A for complete details on LeBlond Hydra-Trace.

turned faster by

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 65 YEARS*



. . . *but*

Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

Red Shield says:

"STANDARD for tough jobs since 1881"

as near as your telephone

Call your Industrial Supply Distributor for Shield Brand Reamers. Specialized factory service available everywhere.

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

You get more parts per hour

PRODUCTION INCREASED 50%
COSTS REDUCED 11.6%

MACHINE TEST REPORT

Stock Size	–5 ⅝" Hexagon
Part Name	–Hose End Blank
Machine	–1-1/4 RAC Acme Gridley
Machine Operations	–Forming, drilling, reaming
End Tool Slide Cos	–1-2
End Tool Slide Feed	– .0065 for B-1113 – .0075 for MX

COMPARATIVE PRODUCTION

GRADE	RPM	SFM	PART TIME (SECONDS)	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	1160	221	6	600	–	–
MX	1556	290	4	900	50	50

*ESTIMATE OF COMPARATIVE COSTS

	B-1113	MX
Net Production Hr. at 70% Efficiency	4[illegible]	650
Hours to make 10,000 parts	[illegible]	15.4[illegible]
Direct Labor	$ 11.70	$ 14.63
Machine Overhead @ $2.275 per Mach. Hr.	[illegible]	$ 35.06
Conversion Cost	[illegible] 74.19	$ 49.69
Material Cost	$144.50	$144.50
Total Manufactured Cost of 10,000 parts	$218.69	$194.19
Saving	$ [illegible] 41	or 11.6

*Note–These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

PRODUCTION INCREASED 51.6%
COSTS REDUCED 17.3%

MACHINE TEST REPORT

Stock Size	–1-1 ⅛" Rd
Part Name	–Pulley Hub
Machine	–6 Spindle Conomatic, 1-1 4"
Machine Operations	–Rough form, finish form, drill, ream, counter-sink, spot, cut-off

COMPARATIVE PRODUCTION

GRADE	PART TIME (SECONDS)	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	[illegible] 8	450	–	[illegible] 2.6
MX	13.3	2[illegible]8	51.6	

†Estimated

*ESTIMATE OF COMPARATIVE COSTS

	B-1113	MX
Net Production Hr. at 70% Efficiency	1[illegible]	167
Hours to make 10,000 parts	[illegible] 4	60.0
Direct Labor	$ 14.[illegible]8	$ 33.50
Machine Overhead @ $2.275 per Mach. Hr.	$[illegible].82	$156.50
Conversion Cost	$190.88	$190.00
Material Cost	$[illegible]93.00	$290.00
Total Manufactured Cost of 10,000 parts	$[illegible]70.88	$472.00
Saving	$ [illegible]8.88	or 17.3[illegible]

*Note–These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

PRODUCTION INCREASED 29%
COSTS REDUCED 8.0%

MACHINE TEST REPORT

Stock Size	–5 4" Hexagon
Part Name	–Master Cylinder Outlet
Machine	–1-1-4 RAC Acme Gridley
Machine Operations	–Forming, drilling, threading, shaving, turning, cut-off
End Tool Slide Cos	–5 8
End Tool Slide Feed	– .006 for B-1113 – .0075 for MX

COMPARATIVE PRODUCTION

GRADE	RPM	SFM†	PART TIME (SECONDS)	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	942	215	7-5.4	465	–	–
MX	1210	275	6	600	29	29

†Calculated from diameter across corners

*ESTIMATE OF COMPARATIVE COSTS

	B-1113	MX
Net Production Hr. at 70% Efficiency	3[illegible]	420
Hours to make 10,000 parts	30.68	35.81
Direct Labor	$ 10.[illegible]6	$ 12.02
Machine Overhead @ $2.275 per Mach. Hr.	$ 69.80	$ 54.17
Conversion Cost	$ 80.18	$ 76.19
Material Cost	$175.50	$175.50
Total Manufactured Cost of 10,000 parts	$275.68	$251.69
Saving	$ 21.99	or 8.0[illegible]

*Note–These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

at lower cost per part

...when you do the job with MX

today's faster-cutting screw stock

● You don't have to take our word for it. When we tell you that U·S·S Free-Machining MX will increase your production and that it will cut the cost of any part you now machine from ordinary Bessemer screw stock, we have the FACTS to back us up . . . figures that speak for themselves.

In the three years that this high speed, freer-cutting bar stock has been on the market, hundreds of shops have put it to the test. Although the more than a billion parts made with MX have been of infinite variety and have been produced under dissimilar conditions and on screw machine equipment of different types—the results obtained have been similar.

Here is what has happened in shop after shop: Output per machine, per hour, per man, has been increased. Time between tool grindings has been extended. Parts finish has been better. Close dimensional accuracy has been easier to obtain. Rejections have been fewer.

And despite its better performance, MX costs no more than ordinary screw stock. Consequently, savings with MX have been invariably recorded. These savings have averaged between 10 and 15%, but also have run as high as 42%. Can you afford to give your competition this edge on you?

Give U·S·S Free-Machining MX a thorough trial. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier either as "MX" or under his own identifying trade name. In hot-rolled form MX is available direct through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
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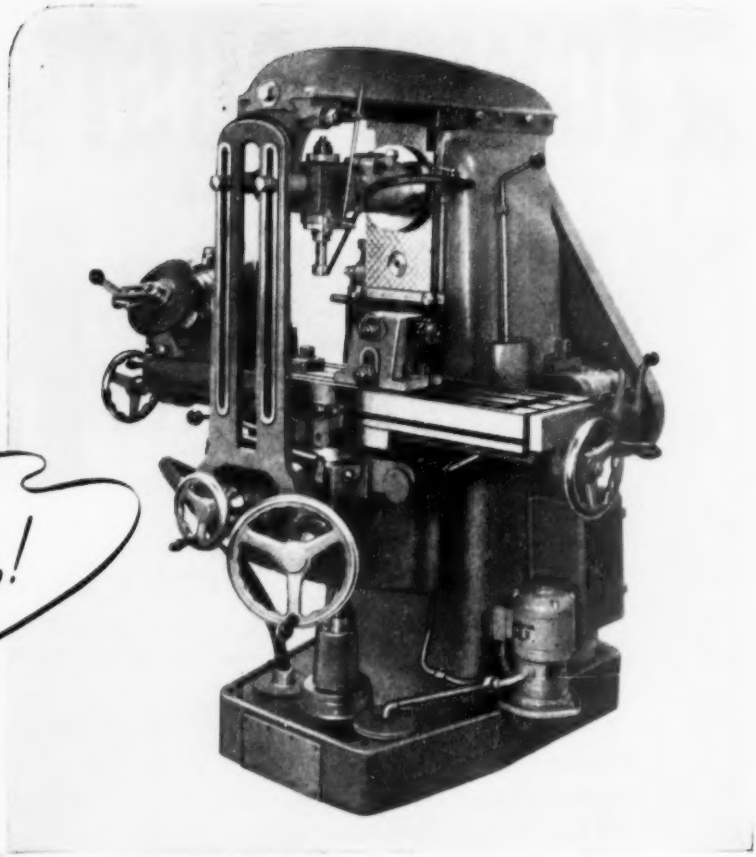
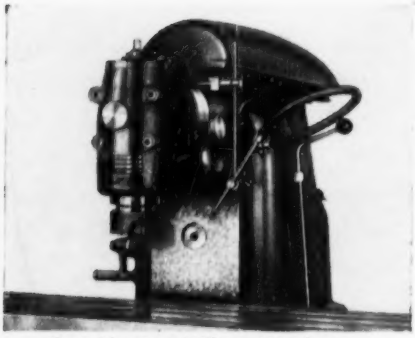
UNITED STATES STEEL



Swedish Craftsmanship!



Sajo Vertical Milling Attachment

The Sajo "Plain" Milling Machine

the SAJO "UNIVERSAL" MILLING MACHINE

exemplifies the expert workmanship that is traditional in Swedish machine tools. Like all SAJO Millers, this new Universal Milling Machine was designed and built to the highest standards of quality and practical utility.

Avoidance of exterior "luxury" features, slight in value but substantial in cost, and concentration on the vital factors of construction, enable the SAJO to deliver top performance at moderate cost.

SAJO Millers are available in Plain and Universal types, with longitudinal power table feed only, or with power feed in all directions. Screws and dials are in the U. S. inch system.

★ **Standard Equipment includes:**
3 HP motor and starter equipment, motor driven coolant system, adjustable table feed nut to allow climb-milling, 1" arbor, arbor support brace.

★ **Extra Equipment:**
Universal Dividing Head, Vertical Milling Attachment, Slotting Attachment, Swivel Base Vise, Rotary Table.

CONDENSED SPECIFICATIONS

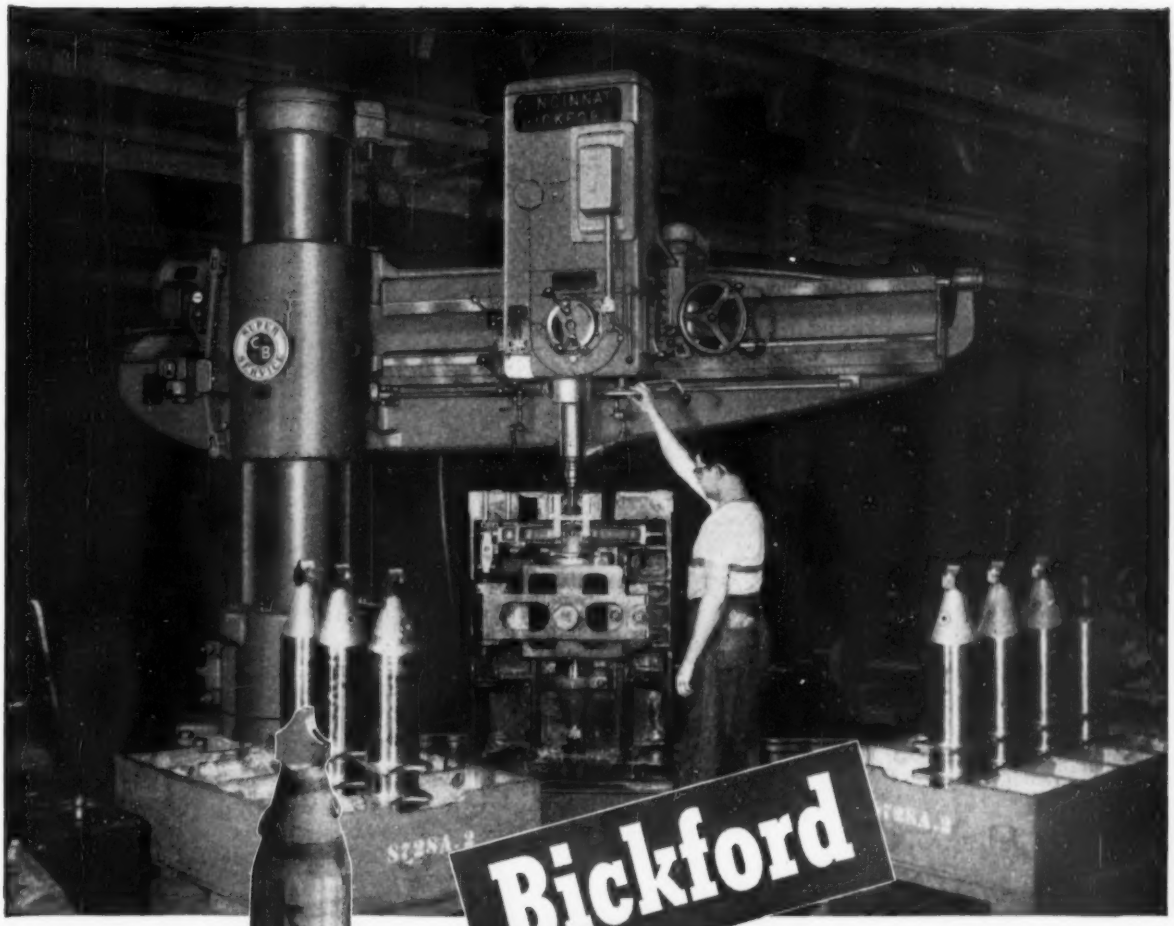
Table Size	41½" x 9¼"
Longitudinal travel: Plain Miller	24½"
Universal Miller	27½"
Transverse travel	8¼"
Vertical travel	19"
12 spindle speeds	36-1540 RPM
Table feeds	12
Taper in spindle	No. 40 NMT
Main motor	3 HP

Precision anti-friction bearings on spindle and gear shafts
One-piece column and base
Net weight—2200 lbs.

Write for Catalog

NO PRIORITY—— PROMPT DELIVERY——ATTRACTIVE PRICE

AUSTIN INDUSTRIAL CORP. 76-F MAMARONECK AVE. WHITE PLAINS, N. Y.
DEALERS IN PRINCIPAL CITIES



Photos courtesy—The Cleveland Pneumatic Tool Company, Cleveland, Ohio.

Bickford gives *complete* satisfaction . . .

The convenient centralized controls, the wide range of speeds and feeds, and the high visibility head of this Cincinnati Bickford Radial Drill are all contributing to fine performance on this job.

The Cleveland Pneumatic Tool Company say "Performance and ease of handling are all that could be desired."

On this cylinder for an aircraft nose type landing gear, drilling, reaming and spot facing operations are being done.

Cincinnati Super Service Radial Drills are accurate, powerful and profitable in the shop.

Write for Bulletin R-29.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

Cut your TOOL GRINDING costs...

CARBO

REGISTERED

with wheels engineered for the job

Choose the *right* grinding wheel for *every* tool grinding job—from the complete line by CARBORUNDUM.® That's the first step toward longer cutting life for your tools... lower maintenance costs in the tool room.

Every tool room grinding wheel by CARBORUNDUM is engineered to do a specific job at the lowest possible cost. You may want faster production of cutting angles, rakes and clearances; or perhaps better finish is more important; or cooler cutting. Whatever features, or combinations of features, you may require—there's a tool room grinding wheel by CARBORUNDUM that's *right* for you ...a wheel with the right grain type and size, the right grade and structure, the right bond. Whether you're grinding high speed steel, alloy, or cemented carbide cutting tools, not only these wheels but coated abrasive belts by CARBORUNDUM will help you cut costs.

Your CARBORUNDUM Distributor or salesman is ready to help you make the right selection of wheels for every grinding operation in your tool room. His wide experience in evaluating all the variables—and coming up with the right answers—makes him the most valuable consultant your tool room can have. Why not call him today? He's listed in the yellow pages under "Abrasives" or "Grinding Wheels."

FREE

two helpful booklets...

tell you many ways to cut costs and improve grinding techniques in your tool room.

THE CARBORUNDUM COMPANY, Dept. AM 81-316
Niagara Falls, New York

Please send me ☐ "Maintenance of Alloy and High Speed Cutting Tools"

☐ "Grinding Cemented Carbides"

NAME _____ TITLE _____

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RUNDUM

TRADE MARK

...the ONLY source for EVERY abrasive product you need

WILL FIT ANY CARBIDE GRINDING MACHINE!
Here is the New Sterling Plate-Mounted Wheel . . . carefully balanced and specially designed for better grinding on any carbide or steel tool. Every feature of the famous Easymount Wheel is . . . new wheel securely cemented to the rigid steel plate. You'll like it!
Years of service in hundreds of leading industrial plants are your assurance of superior grinding with the unusual Easymount and Wheel. Fasten the Easymount to your tool grinder and order wheels as you need them. The Easymount lasts the life of your machine . . unusual economy and grinding efficiency ensure!
THE WHEELS OF INDUSTRY
STERLING ABRASIVES
Plus VALUE
ABRASIVE PRODUCTS FOR
• BETTER GRINDING
• FASTER GRINDING
• LOW COST GRINDING
IT'S TIME-TESTED ACCEPTED FOR

THE STERLING ABRASIVES

OF THE CLEVELAND

BRANCHES . . BOSTON – CHICAGO – CLEVELAND – DETROIT –

IT'S NEW and PROVED FOR BETTER CARBIDE GRINDING

ANNOUNCING

Two STERLING Carbide Tool Grinding Units . . Offering, for the first time, an Important Choice for Superior Results . . .

Now, you can secure the type of abrasive unit you wish for fast grinding of carbide and steel tools. Only Sterling has it—whether you desire the permanence of the famous Easymount and its replaceable wheel, or the same features in a plate-mounted unit, you can have what you want.

With Sterling's Plate-Mounted Wheel and the Easymount setup, you have a wider selection that will fit any grinding machine in your plant, and provide safe, cooler grinding that assures speed and economy every time!

Rigidly mounted on the steel plate with a special Sterling adhesive, the Sterling Plate-Mounted Wheel has survived every test for dependability and safety. We have punished test wheels in every possible manner to make certain this new unit will last longer and give better service than any other wheel on the market. Hundreds of leading industries are using it. It's ready for you and can be shipped immediately upon receipt of your order.

Similar complete stocks are on hand from which you can secure fast delivery of the unique Easymount and its replaceable wheels . . . order the Easymount once and the wheels as you need them.

Forget your tool grinding problems . . choose Sterling's New, Job-Designed, Plate-Mounted Wheels or the Unusual Easymount and wheels, tailormade to solve your particular problem. Our engineers will gladly select the type and style of tool grinding abrasive assembly you need. Write or phone us today.

ASK FOR THESE TWO FOLDERS NOW!

Two foldegs are available to tell you all about Sterling's New Plate-Mounted Wheel and the Easymount Assembly. Prices and sizes are given. Send for your copies today and we will see they are mailed immediately!

and RECOMMENDED WIDELY CARBIDE TOOLS

DIVISION · · TIFFIN, OHIO

QUARRIES COMPANY

LOS ANGELES — NEW YORK — DISTRIBUTORS IN ALL PRINCIPAL CITIES

Keep Your Eye on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy—more perfect holes—more efficiency—longer drill life.

As Illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to 1/2".

No. 510. For Drills 1/4 to 3". 2-3-4 flute.

OLIVER DIE MAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model 5-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

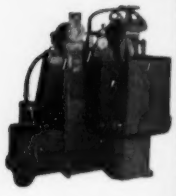
OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15"; also, slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER



Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 1½" wide × 1¾" high from 0 to 20° clearance. The OLIVER is developed for production sharpening of single point Tungsten-Carbide and high speed tools—offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

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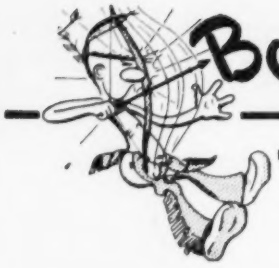


Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Engineers Available

Engineers are harder and harder to get (*AM*—April 27, '53, p117). Here in Germany we have a surplus of engineers, well trained personnel with wide experience. There is no trouble in getting efficient experts accustomed to work on their own initiative and specialized, as desired.

Why should not American companies hire such engineers? You can find applicants by advertising in leading German technical journals, such as *Werkstatt und Betrieb*, Munich, or *VDI-Nachrichten*, Dusseldorf. Applicants could be interviewed by a representative of US industry set up in Germany for the purpose.

This is only a suggestion, but it is worth considering. I enclose a resume of my own experience as a sample of the type of engineer available.

Georg Mosig
Butzbach, Germany

The idea sounds good and, judging by Mr Mosig's experience in aircraft and armament, he would be a valuable employee. American companies in need of engineers might consider setting up an interviewing office in Germany.—Ed.

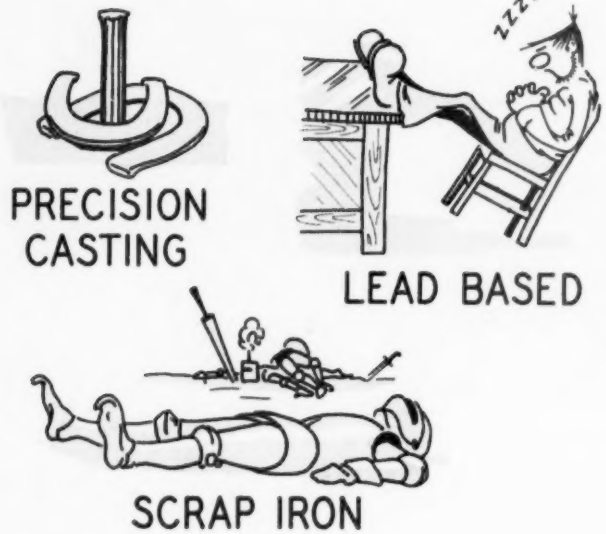
Public Time

Fred Colvin certainly has the right idea (*AM*—July 20 '53, p97). It sure is time we stopped kidding ourselves about gaining or losing an hour each Spring and Fall by moving the hands of the clocks. Despite all the arguments we hear about Daylight Saving time, only ten states on the northeast coast, two on the Pacific coast, and two in the midwest have adopted it, although it is in force in a number of individual cities, including mine.

There is nothing more annoying than to arrive in a strange city, not knowing what time the people are working on. Suppose you have made an appointment with a man for 9 o'clock. You get to his office and find it isn't even open—this place is on standard time and you have an hour

GRINETICS

BY D G SMITH



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Fine Shapers since 1888

You SAVE with a REID Grinder

You might think that a grinder so efficient, labor-saving and precise as a Reid Grinder would cost a great deal. Because the Reid grinder is the preference of operators throughout industry, you might conclude that it is an expensive machine tool.

Actually, from the standpoint of *first cost*, the Reid grinder is economical.

From the standpoint of continued, trouble-free operation, the Reid grinder is an out-and-out money saver.

Its productivity, speed, and ability to improve work soon pay for the original investment.

Because the Reid grinder lessens operator fatigue and steps up production, it is a profitable tool.

and . . . **Reid's co-ordinated design, with its many proven *better* features, which anticipate future grinding needs, makes this masterpiece of machine tools a long-term, all-embracing economy to buy and operate.**

Comparison will prove!

Write for bulletin 618-1.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

to wait. You reset your watch. Next day you have an appointment with a man in another town about 20 miles away, and you find him very angry because you are an hour late—his town is on daylight time. This is not just an idle supposition. It has happened lots of times, and salesmen have often lost important orders as a result of it.

Not that I'm against saving daylight. In fact, in the middle of Summer I think it would be just as well to have a two-hour saving. But why try to fool ourselves by changing the clocks and calling it Daylight Saving Time. Let's all work on the same time and we'll all know exactly where we stand. Why should anybody object to starting work at seven and quitting at four, instead of starting at eight and quitting at five?

More power to Boeing and to Mr. Colvin. Perhaps, between them, they can turn this into a real campaign. If so, I'm with them.

Henry Peabody
Akron, Ohio

Cooled Carbide

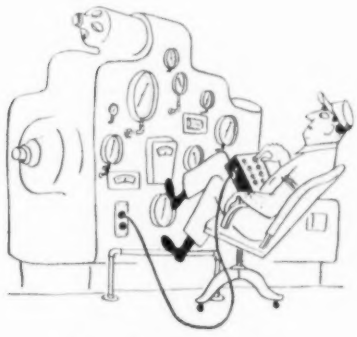
I have just read the interesting article by L St Clair (*AM*—July 20 '53, p129). I agree with practically everything he has to say, as we found out five or six years ago that, by eliminating the coolant, we had a noticeable increase in tool life. However, I cannot quite agree that mechanically clamped tools are as good as brazed-on tips, but if he is using the conventional brazed-on tips I might be inclined to agree with him. We take the carbide out of the cavity and use the nickel shim sandwich braze and, in our estimation, there is no comparison.

It would be interesting if Mr St Clair would try the brazed-on tip with the nickel shim and make his comparisons.

W P Coomey
General Sup't
Rice Barton Corp

Readers may remember that in articles we published (AM—Dec 29 '49, p 55 and March 6 '50, p 85), Mr

Coomey showed that an increase in speed produced the "Coomey Effect," a disproportionate decrease in horsepower. He was subjected to considerable abuse from traditional-minded technical men but, as the St Clair article points out, and as has been shown in other technical articles, his claim is now being supported.—Ed.



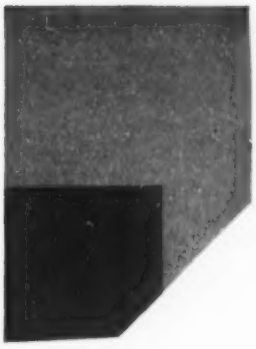
Sweet and Simple

Congratulations to R E Moulton for bringing a little common sense into the all-too-popular notion that more and fancier machines automatically increase production with lower cost. (*AM*—August 3, '53, p132). What too many manufacturers are forgetting is that a machine is only as good as the man who operates it. Their approach is like a group of photographers who were interviewed in a recent survey. The survey discovered that 86% of the camera boys agreed that half their equipment was a pain in the neck to carry around, too expensive, too elaborate and, above all, with a little ingenuity, unnecessary! But they felt they had to have it in order to look "professional." The machine tool industry is beginning to have the same outlook. Actually, it's skill that counts. A highly trained mechanic operating a simple, single-purpose lathe can outdo the production of a less skilled man working an expensive multiple-piece machine. If management would sink more money into training programs and less into fancy, *unnecessary* equipment, it would save them money in the first place, and in the second place, it would force machine tool designers and manufacturers to concentrate on simplicity, accuracy, and economy.

H A Broadbent
Chicago

The field is wide open here for argument. Other readers, both users and manufacturers, hold other opinions. Some are quoted in the article. Would others like to comment?—Ed.

for Special Service on Carbide "Specials"



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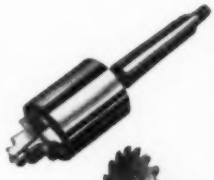

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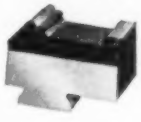

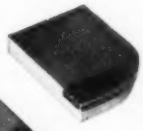

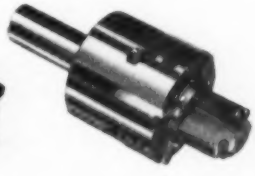

When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

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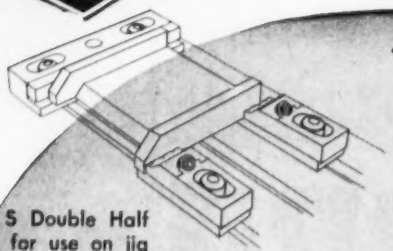
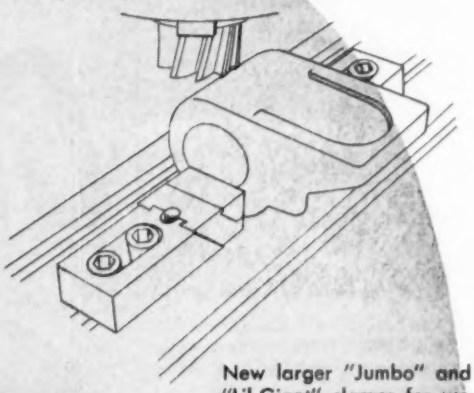
Eliminate U-Clamps, Straps and Fingers

J & S *All-Purpose* JAW CLAMPS

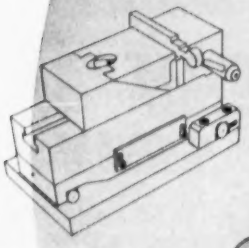
secure work-pieces quickly and rigidly
easily adapted to box fixtures

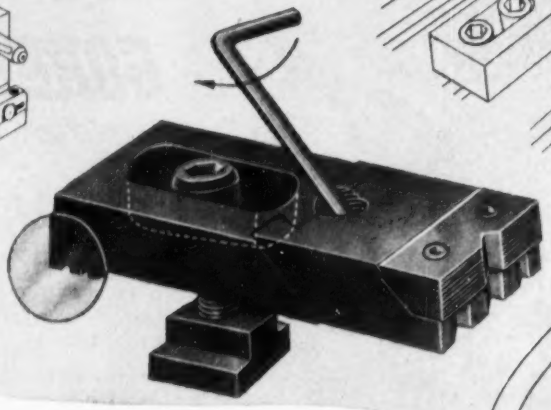


J & S Double Half Vise, for use on jig borers, millers, planers and shapers.

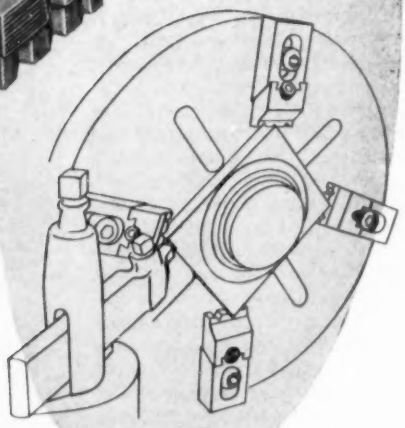


New larger "Jumbo" and "Lil-Giant" clamps for use on larger-type planers.





Precision Grinding Vise with or without sine bar allows rapid unloading and exact relocating.



Typical lathe application. Standard clamp in use.

NEW METHOD OF SECURING WORK-PIECES TO MACHINE TOOLS

for Lathes, Planers, Milling Machines, Boring Millers, Jig Borers, etc. (9 different types including new Counter Clamp)

1. **Faster Set-up:** *One adjusting screw* provides a 5-ton force to *position* and *hold the work-piece.*
2. **Stronger Grip:** The *inward* and *downward* movement of the jaw clamp at a 45° angle gives a *single, powerful clamping action* — easily applied and controlled.
3. **Less Obstruction:** You can pass over the whole clamp 1" from the working surface of the machine face. *No interference with reading or measuring tools.*

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DELIVERY FROM STOCK

WRITE FOR NEW FOLDER!
—contains complete details on advantages, applications, types and sizes available.
Booklet describing J & S "Fluidmotion" Wheel Dressers, etc., also sent on request.

.0001" ACCURACY

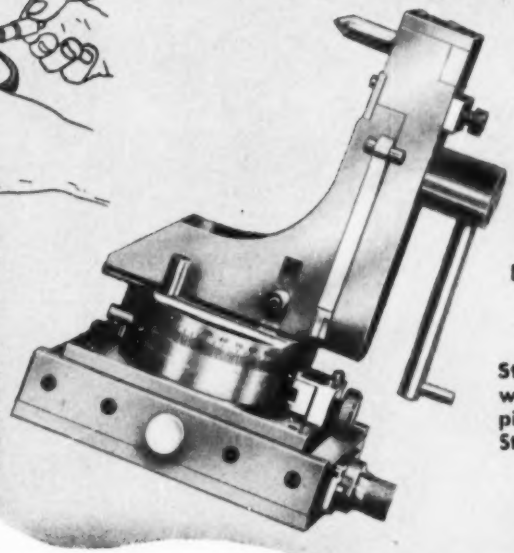
eliminate elaborate set-ups and operations

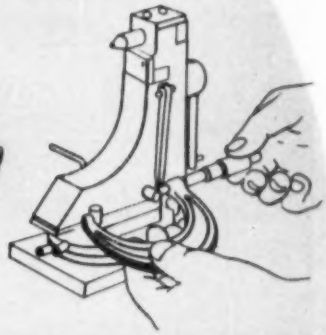
Fluidmotion WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion

High-Carbon, High-Chrome Construction

Step 1. Obtain micrometer reading as shown, and add required convex radius or subtract required concave radius.





Step 2. Next loosen gib with wrench and "mike" over lower pins to reading obtained in Step 1.

Step 3. Tighten gib; set stops for two angles; ready for action.

ADAPTABLE TO ALL TYPES OF CYLINDRICAL AND SURFACE GRINDERS

With the "Fluidmotion" Dresser, you can *dress* two angles *tangent* to a radius—using one handle *in one continuous motion*. Operation is so fast and simple that beginners can use them to boost your grinding machine out-put. Forms are always clean, precise—angles and radii "flow" into each other. Contours are consistently sharp, accurate to .0001", without tool or chatter marks.

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—contains complete details on advantages, applications, types and sizes available.

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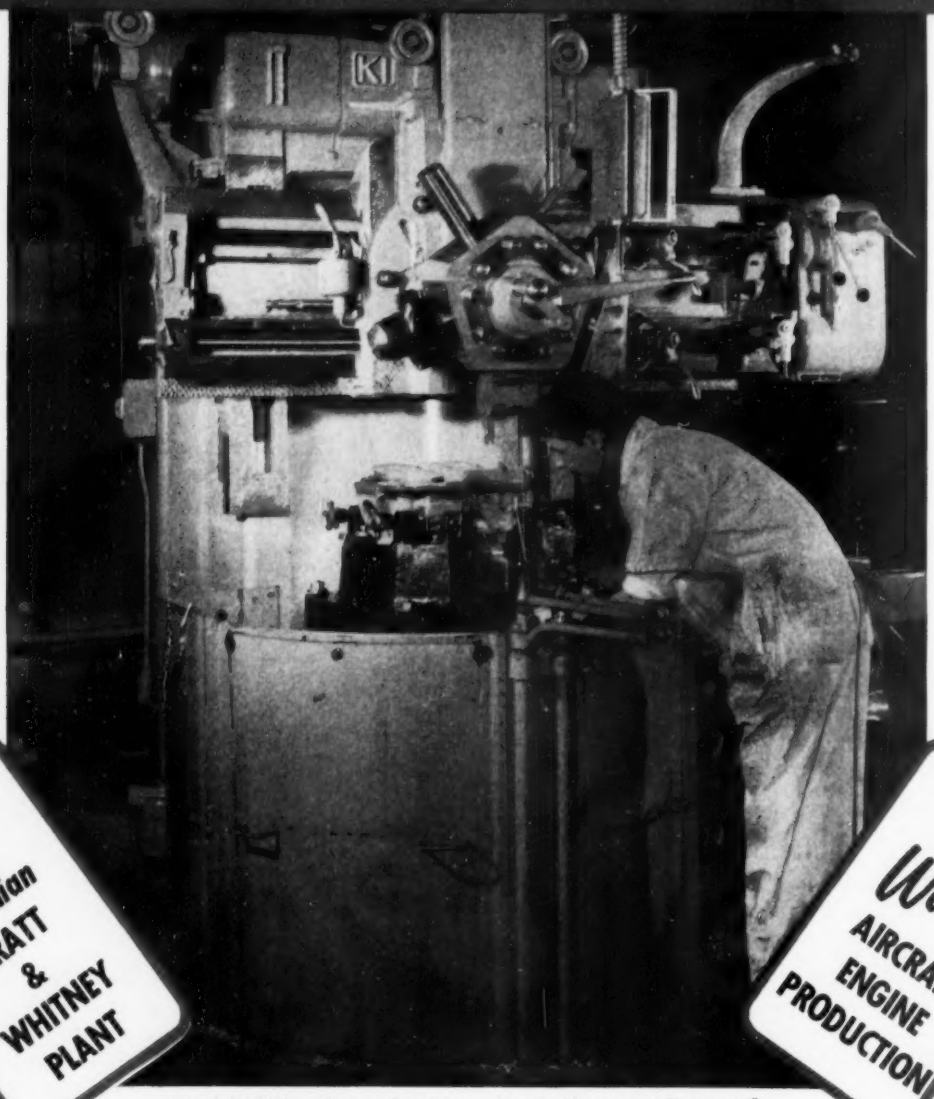


AT New Canadian PRATT & WHITNEY PLANT

ON Wasp AIRCRAFT ENGINE PRODUCTION

One of the KING machines at Canada's new Pratt & Whitney plant. This is a 36" mill, shown machining rear crankcase section of the Wasp aircraft engine.

It's only natural that KING Vertical Boring & Turning Machines should be making a substantial contribution to Canada's, as to America's defense effort. Defense production, particularly in aircraft engine manufacture, demands utmost precision. That's where KING is in a class by itself. KING mills have the extra weight, rigidity, and accuracy that assure maximum stock removal without sacrificing precision or quality of finish. KING machines are made in ten sizes, from 30" to 144", all available in a variety of head combinations. For complete details it will pay you to contact your local KING Distributor —or write us direct.

American Steel Foundries
KING MACHINE TOOL DIVISION

KING
VERTICAL BORING & TURNING MACHINES

7150 Tennessee Avenue
Cincinnati 29, Ohio

SPOT NEWS of Metalworking

- **Index drilling machine drills 180 holes per min, saves 78% in man hours** required to locate and drill pilot holes for rivets in structural aircraft parts. Unit, developed by an aircraft company, will shortly be marketed by a machine-tool firm.

- **Sedro Woolley, Wash., merchants are helping finance metals plant expansion** rather than lose a large industrial payroll. They are buying $300,000 in debentures to help finance a $3 million addition to Skagit Steel & Iron Works, which needs the addition to carry out an Army 105-mm shell casing contract.

National Production Authority has finally discontinued its Report Form NPAF-1, which metal consumers have been filing for over two years. Third-quarter reports will not be required. Instead of the reports, NPA will now make spot checks of individual industries' metal consumption.

- **A California munitions plant has cut its journeyman force from 2500 to 900** and plans to discontinue its apprentice training program. Reason: "We're running out of work . . . we are faced with the choice of sacrificing our apprentices or losing our few remaining skilled mechanics."

- **A new compound, molybdenum disilicide, withstands 1700 C,** is compounded by the powder metallurgy process. Requires no vacuum to resist heat as does pure molybdenum. Proposed application: furnace heating elements.

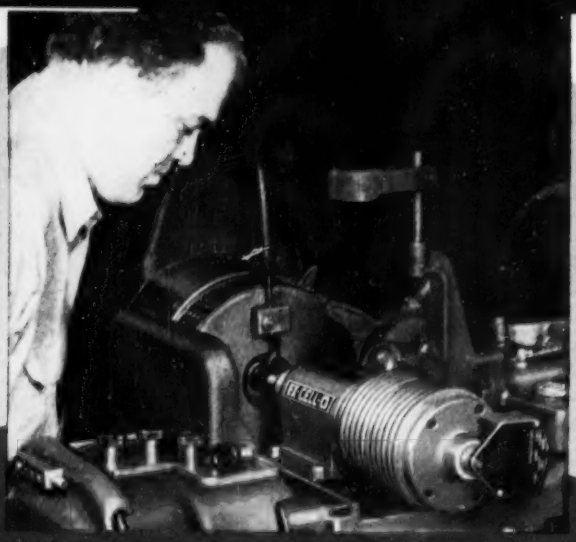
- **Ford will build a $100-million, 1-million-sq-ft stamping plant** in Cleveland as soon as water supply and plant sewage problems are solved. This, plus its present foundry and two-line engine plant, to which will be shortly added a $65-million third engine line, will make Cleveland Ford's largest concentration outside Detroit. Ford's completed Cleveland package will be valued at $400 million, will mean annual production of 1.4-million engines.

- **Automatic heat-treating production line treats up to 50,000 screws per hr,** yet handles threaded fasteners with a jeweler's precision. The 110-ft line takes screws on a 2-hr nonstop ride through 7 operations — weighing, first wash, hardening, quench, second wash, tempering, rustproofing — automatically.

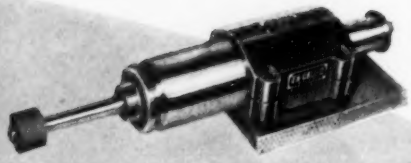
All toolrooms and machine repair and maintenance departments in General Motors plants in and around Detroit have put aside all other work and are busy repairing machine-tools and other production machinery salvaged from the General Motors transmission plant after the fire. For detailed story on the fire and its effects on the US economy, turn to page 130.

- **Ammunition production is to be eased off considerably for the next few months.** Expansion came so fast after the shortage that deliveries are at much too high a rate, even with diversion of shipments to Europe and elsewhere in the world. The Korean truce is partly responsible.

- **Some sort of leasing plan for government-owned machine-tools** to producers of civilian goods is expected to receive the blessing of Washington defense agencies and the Pentagon. NPA has battled to confine the leasing of machines to defense contractors for use on defense work only.



Grinding small holes with an Ex-Cell-O 25,000 RPM High Frequency Motorized Spindle



Single-body, belt-driven internal grinding spindle.

Double-body, belt-driven internal grinding spindle.

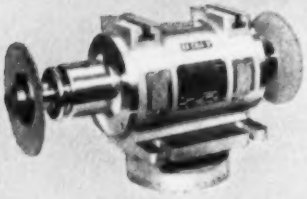
25 hp heavy duty precision spindle with 24" grinding wheel.

PRECISION SPINDLES

Built for Your Work

25,000 rpm high frequency inbuilt motor spindle.

Totally enclosed inbuilt motor surface grinder spindle.



Precision inbuilt motor spindle for cutter grinder.

Heavy duty motorized precision spindle available up to 20 hp

Get the most from your precision grinding operations by using the Ex-Cell-O Spindle that's made especially for the job.

Ex-Cell-O Precision Spindles have long been the original equipment choice of leading grinder manufacturers. They are rigid and smooth-running. For high precision work they are fitted with standard Ex-Cell-O Precision Ball Bearings; for slower speeds and heavier cuts they are equipped with heavy-duty Ex-Cell-O Precision Ball Bearings. They require no lubrication or adjustment. Phone your Ex-Cell-O representative or write to Ex-Cell-O in Detroit today for catalog 25962 listing hundreds of standard grinding spindles.

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

53-32

Washington

Defense Department's new term for the Arms Production Program is the "Dynamic Base." That's what Wilson and Kyes envision for the industrial support behind the military services.

They see the industrial program as requiring constant change to meet conditions confronting the military. In the future, if new outbreaks of shooting occur, it may be necessary to partially activate some of the production lines that have been turning out weapons for the military since June 1950. But, for the present, a lot of them are going to have to go into mothballs.

Deputy Defense boss Kyes adds another element to the reserve industrial capacity. He figures that the reserve lines should not be only tools and facilities, but should also include at least a nucleus of trained technical skill—engineering and crafts alike.

So Kyes is now considering an idea that would permit the defense department to retain the skills by awarding a shut down plant a contract for repair or modernization of machine tools, or a research applications engineering contract for some other weapons where the pilot lines and preliminary production schedules might be worked out.

• • •

Don't look for any big changes in military strategy coming from new Joint Chiefs boss Admiral Arthur D Radford. For one thing, Radford will move slowly, picking up support from the Army and Air Force brass as he goes. Insiders figure that Radford can win over his opposition in the other two services. He's considered one of the most capable men in uniform and one of the shrewdest.

Radford isn't against strategic bombing. He was against the big bombers as an "all eggs in one basket" philosophy. First thing he will do is build up tactical air and ground support, thus making friends with the tactical air generals and the Army—both feel that Bradley and Vandenberg neglected this area.

• • •

You can forget about the the new Small Business Administration taking up where RFC left off and becoming a major lending agency. Though SBA has been authorized to make direct loans up to $150,000 from a $55-million revolving fund, there'll be few direct loans in which the agency will be the sole lender.

From policy shaping up now, you can see that SBA's big pitch will be "capital pools"—like ones set up by civic groups in Maine and Massachusetts —from which small business borrowers would draw. SBA might be a participant in the pools, along with banks, insurance companies, and other lending institutions.

• • •

ODM Director Flemming is having trouble finding an industry man to become his "Assistant Director for Production Requirements and Programs." The man who eventually takes the job could become the government's czar for metalworking in case of full mobilization. He'll have authority to screen defense requirements, set up production goals, and run the production controls setup.

Flemming is trying to steer clear of machine tool executives or officials from companies with big defense contracts. Other industry executives are understandably reluctant to take the job. Presumably, they would have to sell private stock holdings and expose themselves to a barrage of Congressional criticism when and if investigations of the machine tool and other production expansion programs are begun.

• • •

Big job for the new Hoover Commission will be to save money, not just streamline government operations. For the past two decades, government has been doing more things for more people. The aim now is to cut down on what government does — cut functions, spending, then cut taxes, of course.

Task of the first Hoover Commission was more simple: to improve government operations by shifting agencies into a more business-like line and to curb overlapping duties. The new commission will go far beyond this chore. It will try to get government out of many areas where private enterprise can provide needed goods and services. Examples: barge lines (already accomplished), power, machine shops, airways, warehousing.

• • •

Major labor agency appointments have been filled by Eisenhower. Labor leaders can't squawk. The men all had some connection with labor or the Democratic regime.

In the Labor Dept: Secretary Durkin (from Plumbers' Union), Undersecretary Mashburn (from Lathers' Union), Assistant Secretaries Hobart (from Locomotive Engineers), Miller (former head of AFL Education Bureau) and Siciliano (formerly with NLRB).

On National Labor Relations Board: Chairman Farmer (with NLRB in Roosevelt era), Member Rodgers (secretary to the late Sen James J "Puddler Jim" Davis, onetime union official and Secretary of Labor).

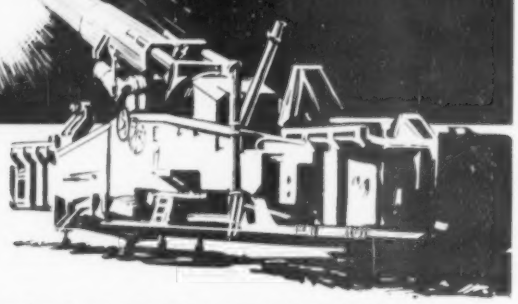
In Federal Mediation & Conciliation Service: Director McCoy (Democrat for Eisenhower who served with NLRB and Conciliation Service).

Microhoning

REDUCES COST

SIMPLIFIES PROCESSING

IMPROVES ACCURACY...



Chosen over other methods, the Microhoning process is being used to generate the inside surface of the new 280 mm atomic gun barrel!

Microhoning . . . corrects all inaccuracies left by previous operations and generates a round, straight bore . . . eliminates several processing operations formerly required to obtain the necessary accuracy . . . facilitates broaching of the rifling by providing a true piloting diameter . . . assures a superior seal between the barrel and the projectile.

Constant improvement in this application has produced a Microhoning tool with a gage built into its nose, simplifying diameter checking and cutting 4/5 off the former Microhoning time!

This is another example of how Micromatic is continually developing new and better equipment for Microhoning all types of surfaces regardless of length, diameter, or material.

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Detroit

The new V-8 engine plant of Buick, which classifies as one of the latest, if not the latest, in the industry, is a splendid thing to behold. There's lots of transfer equipment, of course, and other automaticity. Beyond that, there is a good deal of downright ingenuity.

For example, in hardening flywheel ring gear teeth, the piece is spun in a fixture while brought to red heat by propane gas. The spinning insures an even hardness on all teeth. The flame cycle is for 10 sec.

Valve pushrod ends are formed by cold heading. Raw coil wire is drawn to close tolerance, cut to proper length, then cold headed at a rate of 3000 an hour. Cold heading, Buick production men figure, makes a sturdier, stronger pushrod.

A Cincinnati broach does rough and finished broaching on six surfaces of the crankcase at a rate of 100 an hour. Three crankcases are in process at one time. Each is broached, then turned over at an idle station, then broached on different surfaces. Positioning, of course, is automatic. There are 762 tools on this broach.

The cylinder head combustion chamber is contour milled. A finger, tracing a pattern, guides the mill through the intricate arcs of the chamber, holding the contour and the dimensions within tight limits.

The new engine plant is operating at a rate of about 1200 units a day, but still has problems keeping up with demand. So far this year more than 500,000 Buicks have been built; the rest of the year will see another 175,000 or so built.

From the look of tooling ordered on the new Packard engine—which will not be seen before 1955 models—it looks as though that company has gone the way of Chrysler in designing a hemispherical type of combustion chamber. Packard reportedly gave a good deal of time to examination of both the General Motors and Chrysler approaches, then went the way it did.

There is much talk around the town, incidentally, about the 1954 Chrysler powerplant. It is definitely going to be stepped-up in horsepower; and it is said the block has been beefed up. One wonders where the horsepower race will stop (Chrysler served notice, some months ago, that it could go as high as 400 hp.).

Tooling delays account for the fact that the increase was not put in before now. Original expectations had been to announce it on May 1 and make it available about at that moment. But one thing and another in the way of supply problems led to decision to hold off the increase until 1954 models appear late this year.

Behind the scenes, all companies are driving for cheaper air conditioning. The objective generally is to produce air conditioning which will sell at about the price of an automatic transmission, somewhere in the neighborhood of $200. This is probably a year or two away, but meanwhile there are rumors that air conditioning will be offered in '54 low-priced cars.

• • •

On the score of developments, it should be noted that there is talk of a V-6 engine development at Plymouth. All companies have experimented with a V-6 and are still doing so, but the grapevine rumors are that a project of this sort is farthest along at Plymouth.

For the first time this year, employers in the labor-tight Detroit area can be slightly selective in hiring new workers. Joblessness stood at 34,000 in mid-July, the highest point of the year and exactly double mid-April's low point.

Even so, employment was at near record levels, so that employer leeway in hiring practices was still limited. On June 15, employed workers numbered 1,492,000, an all-time peak. On July 15, employment was 1,487,000. The increase in unemployment was largely due to defense cutbacks, the entry of June graduates into the labor market, and layoffs at scattered auto and auto supplier plants.

From here on there will definitely be more leeway. The Detroit Transmission fire and its effects have caused idleness of around 50,000 people today, and many of these are looking for new jobs rather than waiting for callbacks where they have seniority.

Output in the industry fell off immediately as a result of the fire. With Pontiac, Oldsmobile, Cadillac, Lincoln, Nash, Hudson, and Kaiser affected, volume declined in the third August week to less than 140,000. Previously it had been in the 155,000 range.

What with fire effects, changeovers and the gradual windup of 1953 model year programs, it appears that volume during the next month or two ahead will be materially lower.

• • •

General Motors statisticians have been looking at used car prices and have come up with interesting conclusions — conclusions that tend to reduce recent worry over used car prices.

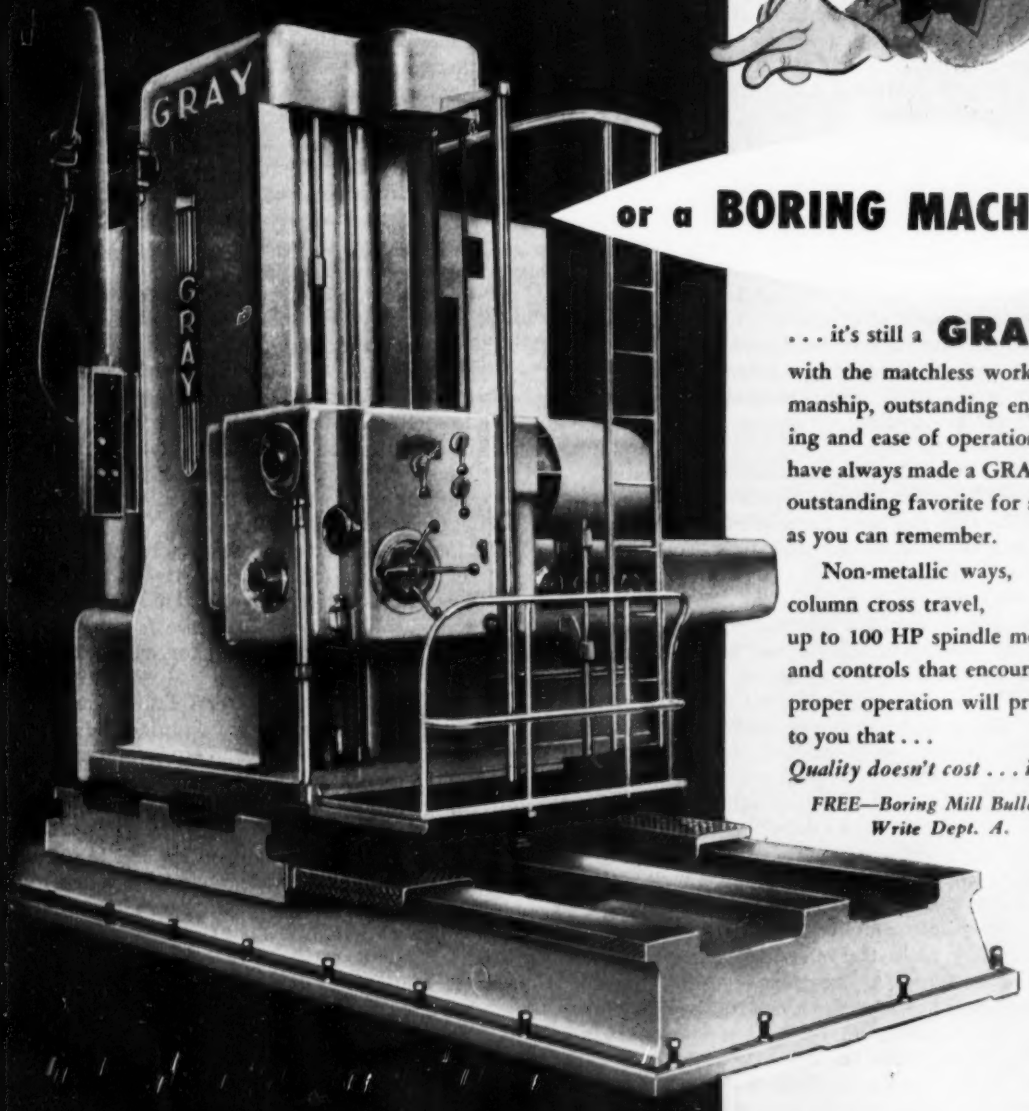
Before the war, they found, the average car depreciated 27% in its first six months of ownership, then 2% per month thereafter.

Starting last fall, depreciation has been at a rate of about 2.4% per month. Thus, for the first year of ownership, today's cars are depreciating only three-quarters as fast as before the war.

But the GM Hydra-Matic plant fire could change the depreciation outlook completely — at least for several months to come.

whether it's a . . . PLANER

or a BORING MACHINE



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Machine Tools

Machine tool procurement problems arising from the disastrous fire at the General Motors transmission plant have absorbed the attention of many builders the past two weeks.

Only about one-tenth of the machines in the plant can be salvaged, according to best reports.

Many builders visited the plant within a few days after the fire to attempt to survey the damage to their machines. But the fire smoldered so long that a complete survey had to be delayed.

• • •

One builder had about 350 machines at Livonia. Some 80 of them have been turned over to a Detroit tool shop for possible rebuilding.

General Motors, in its attempt to get things going again, has looked over the pool-order machines in possession of GSA to see whether any might be suitable. GSA now owns 597 machines.

For detailed story on the fire and its effects on the machine tool and tooling industries, see pages 000 to 000.

• • •

A two-man team from NPA and GSA is visiting major pool-order contractors. They are discussing voluntary reduction in pool orders and also in machines yet to be delivered under the machine tool facilities program.

Federal agencies would be a lot happier if their liability arising from pool orders and facilities could be cut down.

GSA has facilities contracts with 120 machine tool builders. Of that number, 63 have been completed, 54 ar yet to be finished, 3 have been cancelled.

• • •

2087 machines valued at $36 million have been delivered. That represents 85.6% of the total.

Some 265 machine tools remain undelivered. They are valued at more than $6 million.

An unobligated $1 million is being kept on GSA's books, in connection with the facilities program, to be used if desirable for "additions and revisions to present contracts."

74,125 machine tools worth $916 million have been delivered to customers by pool contractors.

12,262 machines are yet to be delivered. GSA has acquired 597 machines, as already mentioned, from 11 builders. GSA paid 12.5% of list price, which was $2.4 million. These machines are still in builders' shops.

• • •

A decision is nearing on the leasing of surplus government-owned machine tools for civilian production. Pentagon is for it and NPA against it.

Best guess is that some sort of leasing arrangements, at least on a limited scale, will be approved jointly by the Defense Department, ODM and the Commerce Department.

The plan of Army Ordnance to lease machines from its "production packages" to its prime and subcontractors for civilian manufacture will stick.

• • •

The elephant tool program, whereby certain builders of big machines would expand their facilities at government expense to be ready in an emergency to increase output sharply, hardly got started.

$50 million of borrowing authority was granted, but only two contracts were signed. Two or three others are pending on a bookkeeping basis, as the expansions are an accomplished fact.

• • •

New orders for machine tools in July stood at 247 on the index of the National Machine Tool Builders' Association (see chart).

That compares with 273.4 in June. This decline was in line with predictions.

Shipments slipped badly in July as a result of widespread vacation shutdowns. The NMTBA figure for July is 264.5, as against 342.2 in June.

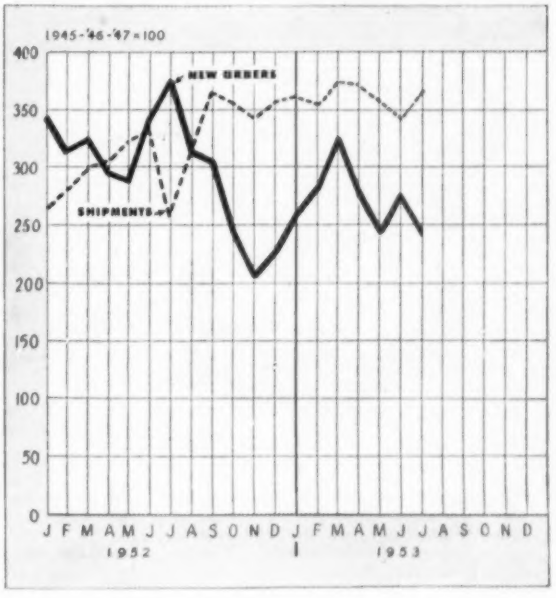
Backlogs for the industry still average over seven months. But the condition is not uniform, some builders having a 22-months' pileup of orders and others only a few months's backlog.

BF

MACHINE TOOL INDEX

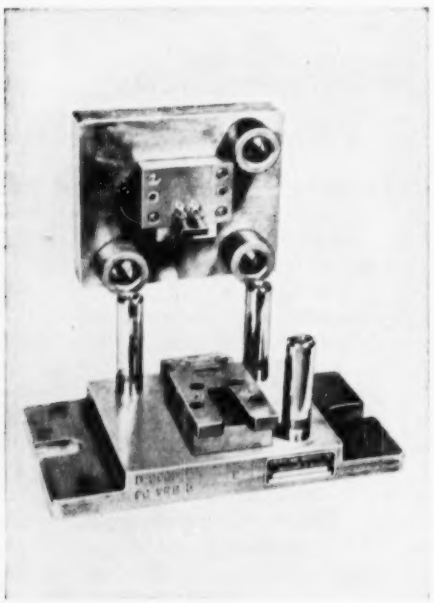
(1945-47 = 100)

(Source: National Machine Tool Builders' Assn.)



Whether your dies are simple...

you can speed production, save time and money,



1 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require resharpening.

Actual performance records prove carbide dies effective over wide range of uses

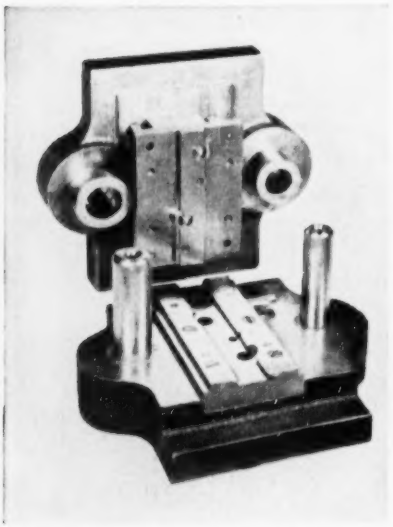
ACTUAL plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 7)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 1)**
- **Accurate tolerances held for months . . . compared to days with steel (see picture No. 6)**

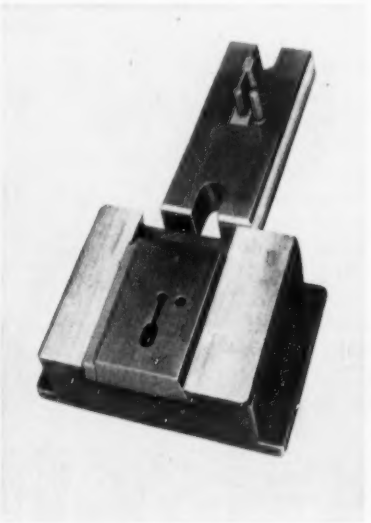
Read the case histories on these pages. They are but a few from the wide range of carbide press-die applications. Then explore the possibilities of carbide in your press dies. Carboloy personnel and services will give you or your die maker every possible assistance.

If you wish, a Carboloy Sales Engineer will call at your plant, without obligation. He'll show you how simple it is to apply and maintain carbide dies; how to get increased production with fewer rejects. Or, you can send your key personnel to the Carboloy Training School in Detroit.

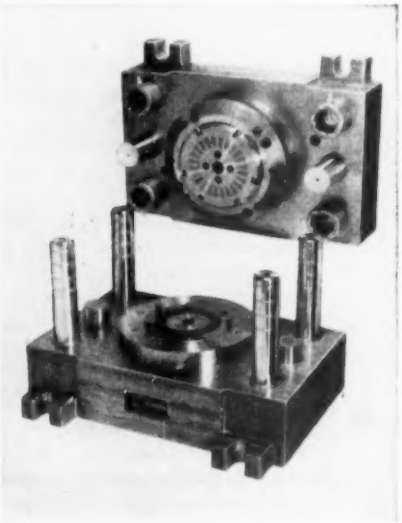
Also, you can get free Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. Get all these free, profit-building Carboloy services by mailing the coupon at right.



2 Simple progressive washer die, used at Precision Spring Company, Detroit, Michigan, pierces and blanks spring-tempered steel washers. This die delivers several million hits per sharpening.



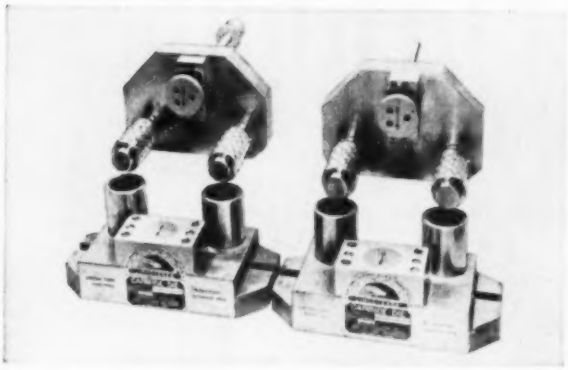
3 Notching die, wearproofed with Carboloy cemented carbide, stands up under severe day-after-day pounding. Because carbide wears 10 to 50 times longer than steel, maintenance costs are lower.



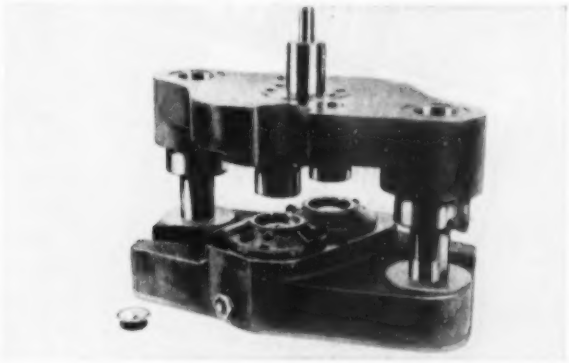
4 Piercing die, made for E.M.F. Dordt, Holland, was designed to pierce a small stator in 24 places. When dies have been wearproofed with cemented carbide, production increases, downtime decreases.

or whether they are complex

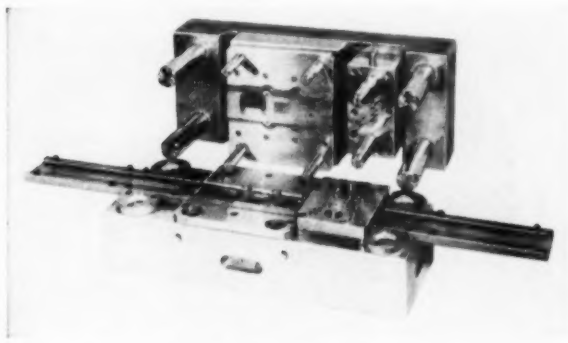
by equipping them with CARBOLOY®
CEMENTED CARBIDE



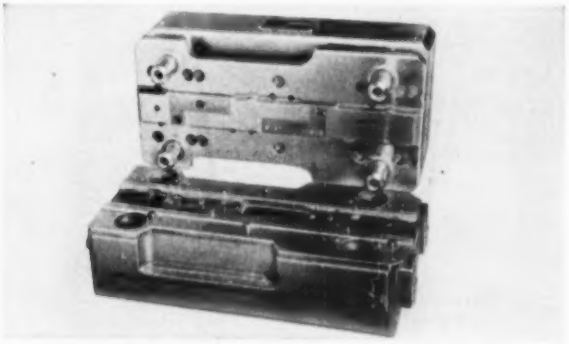
5 Single notching dies, also made for E.M.F. Dordt, Holland. Special design permits details to be interchanged on the same shoes to take full advantage of the carbide in short-run production.



6 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.



7 Lamination die made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



8 Lamination die punches two, high-silicon "L" laminations per stroke. Dies of this type are in use throughout the metal-working industry, outwearing and outproducing steel dies time and again.

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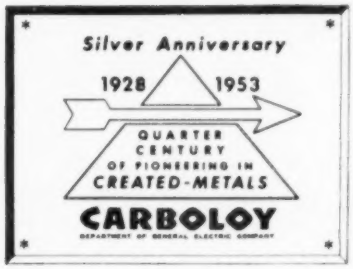

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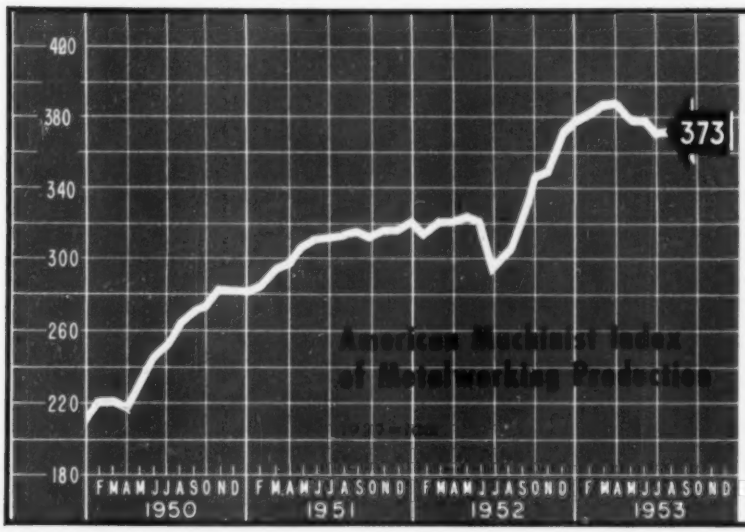
Gaging Metalworking



PRODUCTION INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	AUG '53(*)	JULY '53(p)	JUNE '53(r)	JULY '52
Tot. Index..	373	373	376	293
Machinery	331	338	296	
Electrical Machinery	402	415	332	
Autos	324	316	162	
Other Transportation	596	594	538	
Other Metalworking	366	371	287	

(*) Estimated (p) preliminary (r) revised

Metalworking production is holding tenaciously to a very high rate. It appears likely to ease off in the weeks ahead. But don't look for a precipitate decline.

• • •

Metalworking jobs still are hard to fill. Experienced machine operators and maintenance men are in stiff demand. So are graduate engineers. All of which is a good indication that the situation continues to be strong, despite management's mental reservations about the future.

• • •

Buyers are becoming more cautious. That applies to purchase of steel and other materials. It also is true of orders placed by distributors for machinery and perishable supplies.

Farm implement business is one of the weakest spots. Factories have sharply curtailed output. And dealers are pretty well loaded with farm goods of all types.

• • •

A mixed situation exists in household appliances. Makers who felt confident about being able to hold to a high production clip are cutting down a bit. They admit that the fourth quarter "is full of question marks."

At least two appliance manufacturers have been shut down for two weeks because of a lack of orders.

• • •

Stamping industry is still far ahead of what could be called normal. The drop in business in July was only 5%, or much less than was expected by informed sources.

Most jobbing stampers are getting steel orders on mill books for fourth quarter. They thus will be out from under premium-priced steel.

The industry is well ahead of last year's volume and probably will finish out the year on the present plateau of business, except for possible curtailment in automotive orders.

• • •

Rush orders for tools and dies, sparked by the General Motors transmission plant fire, have quickened the tempo in a considerable portion of the contract tool and die industry.

Detroit is most affected, of course. But orders have spread out far beyond Michigan.

• • •

Backlog of the tool and die industry has shrunk about one-third from the post-Korean peak in December 1951. The drop has not been as bad lately as earlier in the year.

New orders for tool and dies have been declining. Defense work still is important, varying from 20% to 50% in different centers.

Outlook for tool and die shops is excellent to good. No area is suffering for lack of work.

• • •

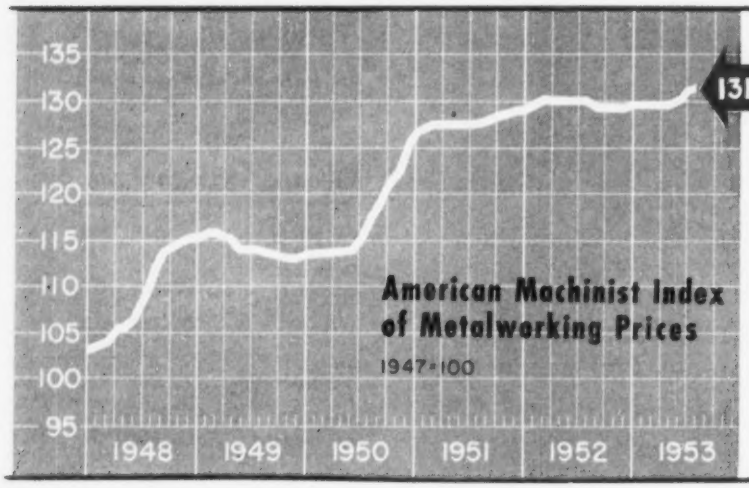
Orders and shipments are down in the independent screw machine products industry.

Current deliveries by shops are off as much as 30% from the peak attained in April of this year.

The present downward trend is not expected to halt for a while. Customers no longer feel the need for restocking inventories and for placing rush orders.

Even so, conditions are not to be regarded as alarming. They are beginning to return to normal as against recent excesses.

Gaging Business



PRICE INDEX

	AUG '53(*)	JULY '53(p)	JUNE '53(r)	JULY '52
Total Index	**131.6**	**136.1**	**130.9**	**129.4**
Metalworking Machinery	**140.8**	**140.2**	**137.8**	
Other Machinery exc. Electrical	**135.6**	**135.0**	**132.2**	
Electrical Machinery	**129.5**	**129.3**	**123.9**	
Fabricated Metal Products	**128.5**	**127.8**	**127.8**	

(*) Estimated (p) preliminary (r) revised

Business is holding up remarkably well all along the line. It thus far has defied the forecasters who insisted that it would turn down.

The year will record a decline in net farm income from $14.3 billion to about $13 billion. Lower prices are the cause.

There has been a slump in household appliances from the exceptionally high rates early in the year.

Housing starts, moving against their usual seasonal course, have fallen off slightly.

But pretty generally otherwise, the economy seems to continue to roar along at or near full capacity.

• • •

It is possible that the vacation season, which has the effect of knocking out some key indexes, obscured some fairly basic changes. If it did, there is nothing to show it now.

There still is reason to believe that a modest decline in business is in the cards toward the end of the year. It will come in consumer durable goods, especially automobiles, and in steel.

Never before in July has employment been as high as it was this year. Census Bureau estimates that 63.1 million were at work, topping July 1952 by nearly 900,000.

There was a significant upswing in the number of men in factory and in construction work.

• • •

New orders placed with durable goods producers have been dropping. On the other hand, non-durable goods manufacturers have shown a nice gain.

Inventories have been rising steadily, especially in the durable goods industries. That is a warning that cannot be disregarded indefinitely. Even in non-durables, the inventory trend is up.

• • •

Electrical machinery and fabricated metal products are not doing as well sales-wise as they were. The decline has been especially sharp in the former.

Housing starts amounted to 96,000 in July. That is a dip of 7% compared with June.

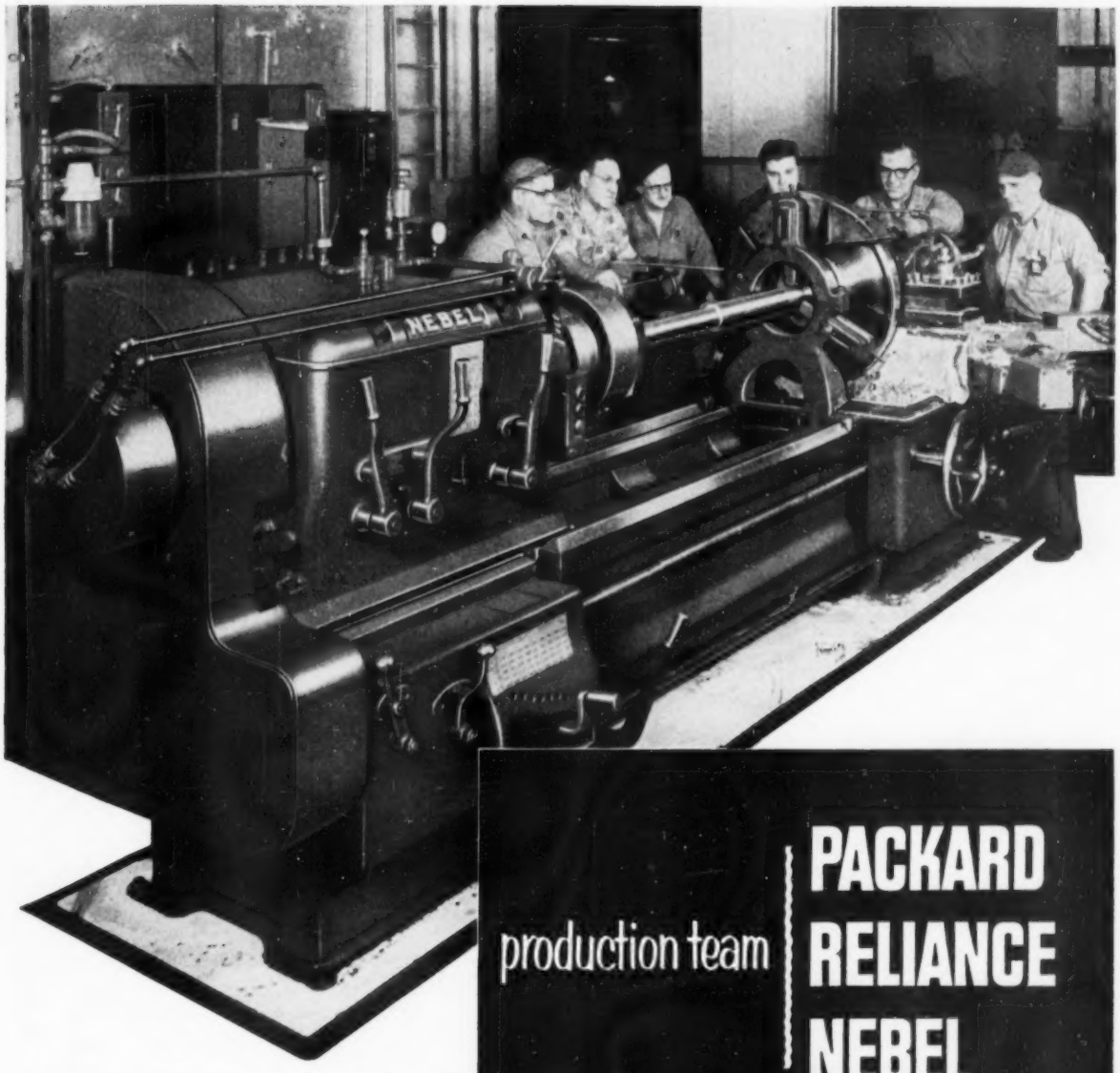
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	258.9	256.6	232.0
Steel ingot operation (thousands of tons)	2,170	2,146	2,017
Electric power output (million Kilowatt hours)	8,514	8,464	7,627
Production of automobiles and trucks	155,179	137,671	36,890
Engineering construction awards (*Eng. News-Record* — millions)	$259.0	$311.3	$136.6

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1935-1939 = 100)*	232	241	193
Index of durable manufactures production (1935-1939 = 100)*	311	321	230
Durable goods manufacturers' sales, millions*	$12,949	$13,238	$10,060
Electrical machinery manufacturers' sales, millions*	$ 1,376	$ 1,361	$ 1,154
Other machinery manufacturers' sales, millions*	$ 2,044	$ 2,097	$ 1,964
Durable goods manufacturers' new orders, millions	$12,053	$12,744	$13,138
Electrical machinery manufacturers' new orders, millions	$ 1,013	$ 1,426	$ 1,355
General machinery manufacturers' new orders, millions	$ 1,861	$ 1,956	$ 1,908

* Seasonally adjusted



8 Nebel heavy duty engine lathes like this are on the job in the jet engine program at Packard Motor Car Co., Detroit.

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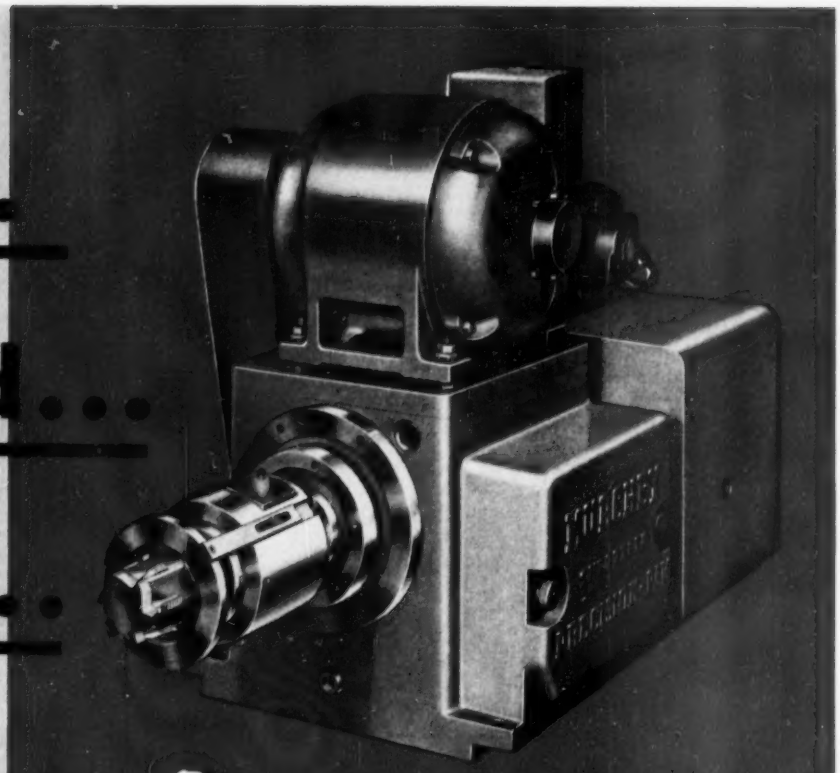

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External Pipe Threads	⅛" to 3"
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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

The Fire That Couldn't Happen

What a fire! It swept through the General Motors transmission plant at Livonia, Michigan, so fast that employees were trapped and telephone lines burned out before word could be flashed to the fire department. It gutted a mammoth factory that everyone thought was fireproof.

Its disastrous effect upon automobile production is hardly yet fully measured. It has caused widespread shutdowns both inside and outside General Motors. At least 15% of new car output for the industry has been knocked out for at least eight weeks. That represents a lot of jobs.

The fire and its disrupting results raise important questions. What can be done that has not already been done to guard against destruction by fire in huge one-unit plants like the General Motors transmission factory?

Much inflammable material must of necessity be used in such plants. Apart from the usual mechanical safeguards, the human element is present. Men must be trained and constantly alerted to the need for caution.

One could scarcely find a more dangerous place in which to work than a powder plant or, let's say, an atomic plant. Yet accidents of any kind are few in such plants. This amazing safety record is made possible by the extreme caution shown by everyone, from top to bottom. Such caution, as we know now, might well be extended to plants that seemingly are less hazardous in which to work.

Fire can lick its way through a metalworking shop at express-train speed without warning. Much better to prevent it in the first place than to try to cope with it after it has got a start. That means that it is desirable to use every possible fire preventive and to lay down rigid rules of conduct by workers to guard against fire.

The General Motors fire raises another question. How well organized are you to handle the situation should disaster ever strike your shop? The Norton Co did a magnificent job when its new machine-tool-building plant was struck by a tornado recently. General Motors is doing an equally superb job in coping with its current misfortune. Could you do as well in an emergency, whether it be a fire or a hurricane or something else?

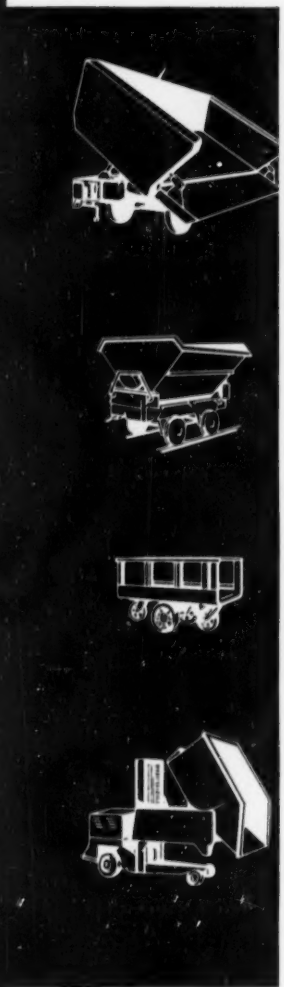
Still another question will not down as one contemplates the production losses, in cars and jobs and far-flung economic effects, stemming from the General Motors fire. How wise is it to put so many eggs in one basket?

The consequences of this single disaster would be more terrifying if this were wartime and our Defense Department had concentrated production of a vital defense weapon, or a main component thereof, in this General Motors plant. We would be out of production for eight weeks and would have virtually no other source to turn to. It is hardly a thought that makes one cheer for a national program of narrowing our production base rather than widening it.

The main point is that we cannot afford to dismiss this disastrous fire as a freak that can't possibly happen again somewhere else.

Burnham Finney

EASTON simplified production and improved product with this CINCINNATI Press Brake



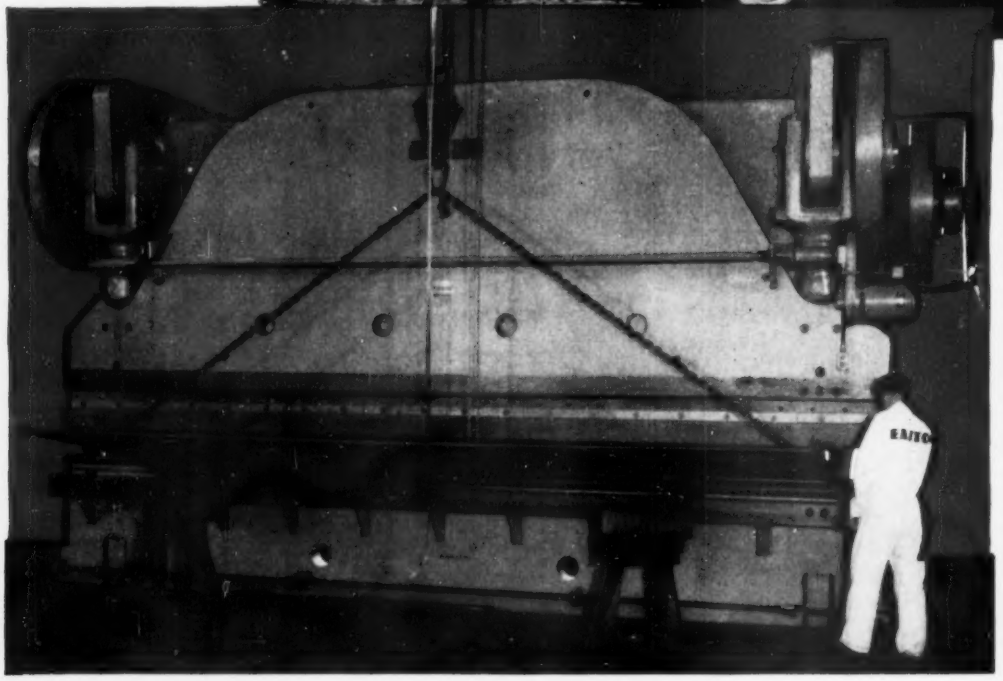


Illustration courtesy Easton Car & Construction Company, Easton, Pennsylvania.

Here a Cincinnati Press Brake is forming ½" plate for wide sections of off-highway trailers, at the Easton Car & Construction Company, makers of a large line of products for industrial transportation.

By using this Cincinnati Press Brake, some welding operations were eliminated, which improved the product, and reduced production costs at the same time.

The power, accuracy, and versatility of Cincinnati Press Brakes are reducing manufacturing costs where ever they are installed. If you form, or bend, you should investigate their possibilities.

Write for Press Brake Catalog B-4.

CINCINNATI

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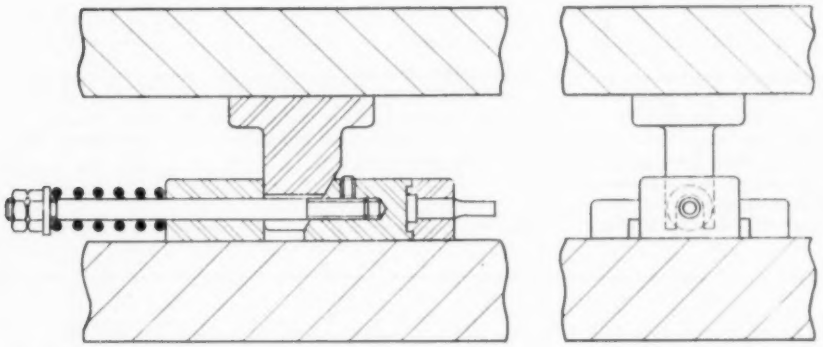
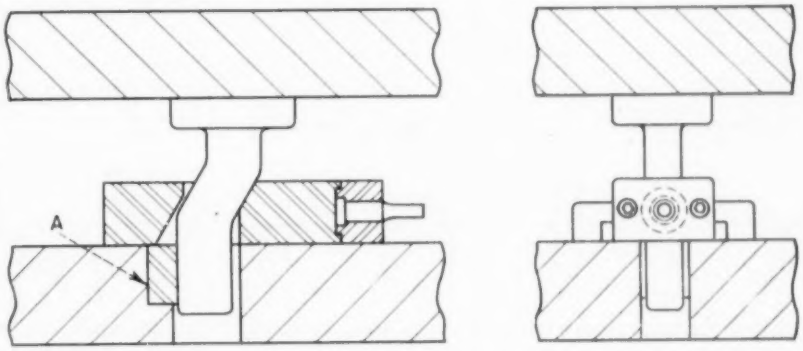
Side cams solve die-design problems

By J. R. PAQUIN

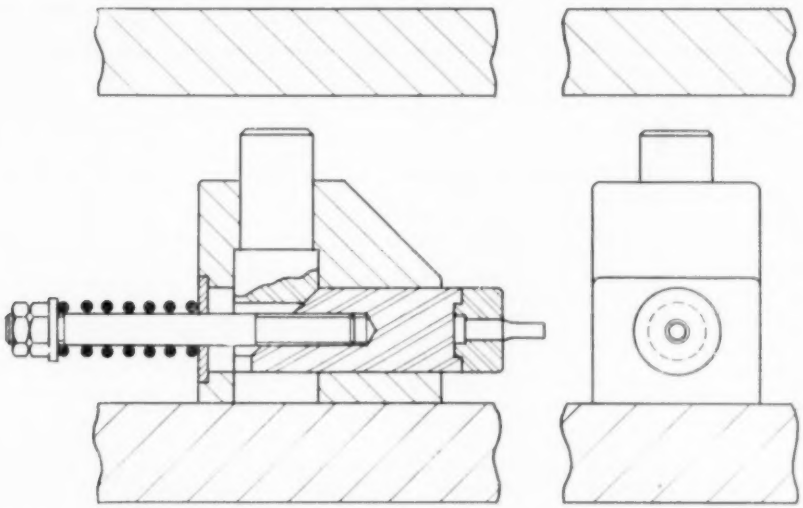
Side cams convert up and down movement of the press ram into angular or horizontal motion of die components. By the use of side cams, additional functions can be performed by the die, or die construction can often be simplified



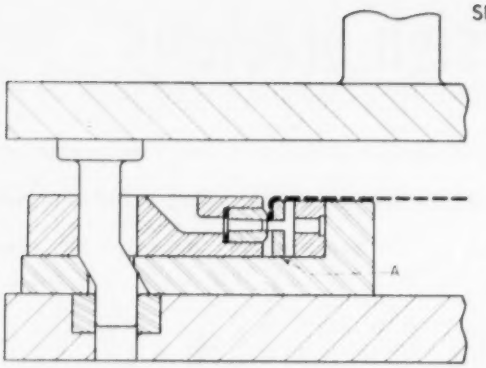
FOR PIERCING A HOLE in the side of a shell, a side cam, mounted on the punch holder, positively moves the slide to the right. A heavy die spring returns the slide to its original position when the press ram goes up. This arrangement is commonly used when return pressures are low. For Class A dies, a hardened wear-plate is applied under the slide. Gib screws go through the wear-plate and are threaded into the die holder



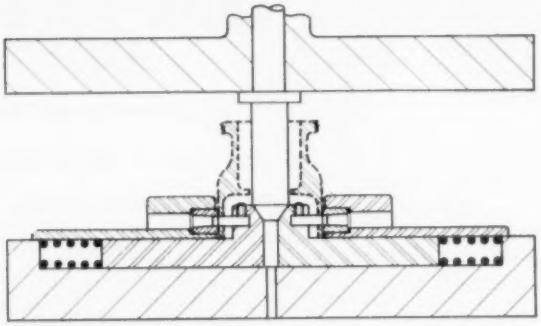
WHEN RETURN PRESSURES are high, and for all Class A dies, a positive-motion cam is preferred. Hardened block *A* backs up the cam during the forward stroke. The piercing punch is of the headed type, and its holder is rabbetted in the slide for concentricity. Both the cam and the slide are heat treated. The holder for the piercing punch should be tool steel, left soft



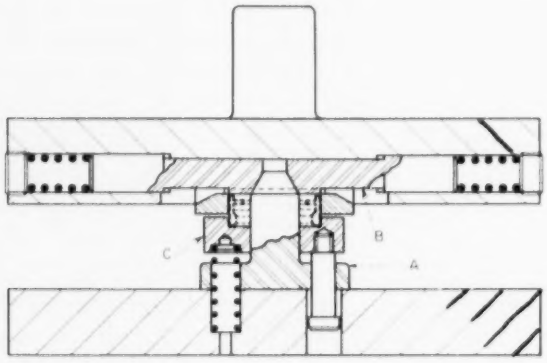
SELF CONTAINED, this unit is simply fastened to the die holder by screws and dowels where required. The punch holder itself, or a suitable bumper block, actuates it. Shops doing a lot of side piercing find it economical to standardize on this type, because with slight modification, it can be used for a wide variety of jobs. Spacers are used under the body to set the height of the punch centerline



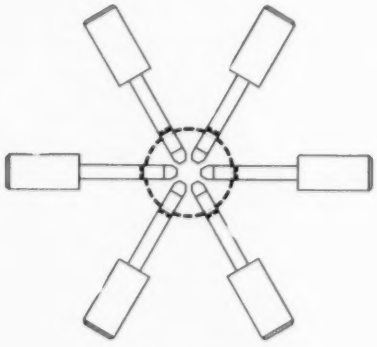
PIERCING FROM THE INSIDE is necessary when covers fit over other components with little clearance and burrs can not be tolerated on the inside of the part. The die button is backed up by spacer washers, more being added as button length is reduced by sharpening. Ring *A* locates the cover and also guides the piercing punch. Slugs are pushed up to the surface of the die-button holder where they are blown off by air. Cam and slide are shown at the bottom of the press stroke



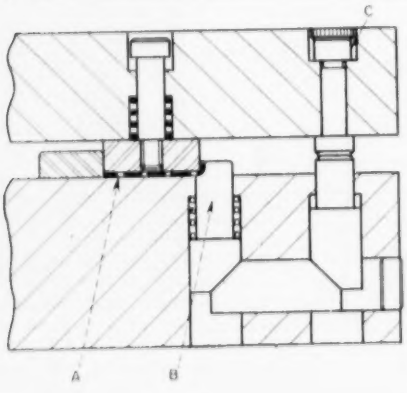
A BEVEL-ENDED PLUNGER actuates six slides in this die for piercing holes in the side of a screw-machine part. A requirement was that no burrs be left on the inside of the part. The die buttons themselves locate the part, and suitable springs return the slides on the up stroke of the press ram



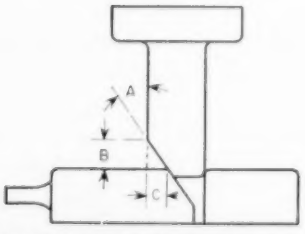
SIX SLOTS ARE CUT in the edge of a screw-machine part by this die. Stationary cam *A*, round and tapered at the end, actuates the hook-shaped cutting punches *B*, upon descent of the upper die. Heavy springs return the punches to their original position when the ram goes up. The part is first located in spring-loaded nest *C*. Slugs are channeled to the surface of the die holder and are blown to the back of the press by air



Plan arrangement of punches



WHEN LAYING OUT multiple-station progressive dies, it is often desirable to bend a tab upwards without moving the entire strip. This is accomplished by the cam arrangement illustrated. Pressure pad *A* descends and securely holds the strip while form punch *B*, actuated by the upper punch holder through side cams, goes up, bending the tab. The punch holder contacts the pressure pad at the bottom of the stroke to "spank" the strip and more accurately "set" the bend. Allen-nut *C* secures the actuating plunger to the punch holder

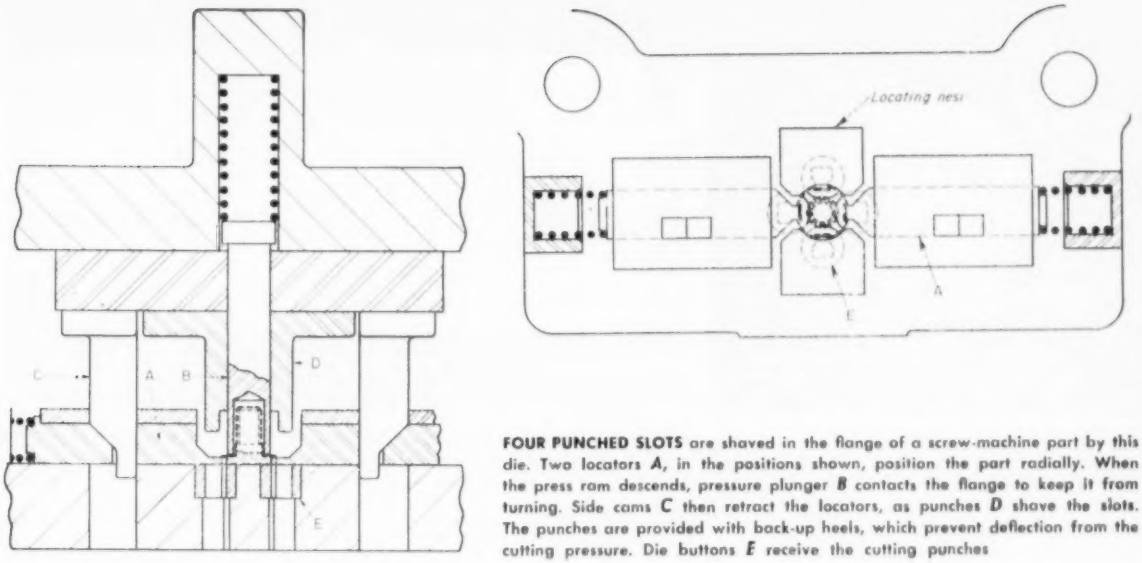


WHEN DESIGNING SIDE CAMS, angle *A* is generally from 30 to 35°. However, it is not always possible to stay within these limits where long strokes are involved.

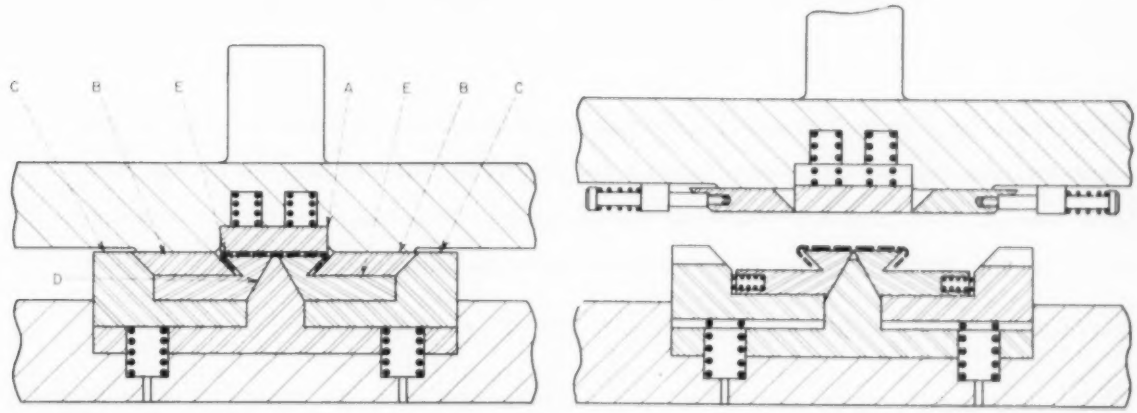
$$B = C \times \cot A$$

$$C = B \times \tan A$$

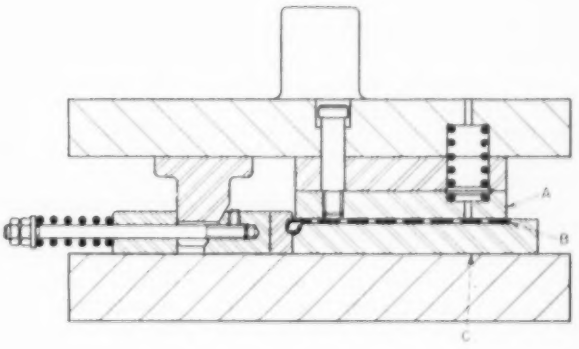
Where: *A* = cam angle, *B* = vertical travel, and *C* = slide travel



FOUR PUNCHED SLOTS are shaved in the flange of a screw-machine part by this die. Two locators ***A***, in the positions shown, position the part radially. When the press ram descends, pressure plunger ***B*** contacts the flange to keep it from turning. Side cams ***C*** then retract the locators, as punches ***D*** shave the slots. The punches are provided with back-up heels, which prevent deflection from the cutting pressure. Die buttons ***E*** receive the cutting punches



TWO ANGULAR BENDS are applied to a flat blank by this die. The blank is located in a nest (not shown). Descent of the press ram causes pressure pad ***A*** to clamp the part, while form punches ***B*** first bend the flaps downward at right angles, then actuated by side cams ***C***, to the angle shown. Stationary cam ***D*** collapses form punches ***E*** for quick and easy part removal



CURLING ONE EDGE of a long flat blank is accomplished by a spring-returned side cam, with the blank held securely by pressure pad ***A***. The blank is positively backed up by edge ***B***, machined in the curling punch ***C***. The pressure pad bottoms at the lowest point in the stroke to "set" the curl. By employing a side cam on this job, it is possible to use the die in a press with a low shut height

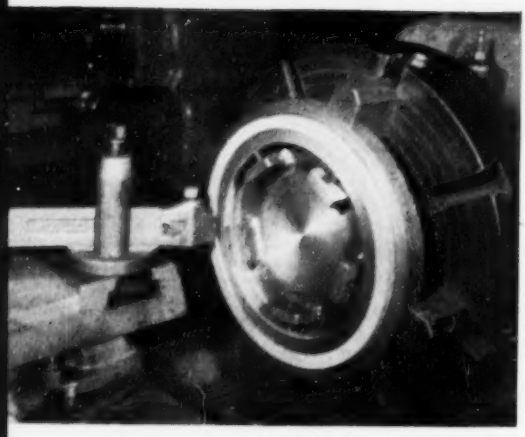


FIG. 1 . . . **A SPECIAL CHUCK** with five jaws was devised to center and grip cast rings for tool-life turning tests on thin sections

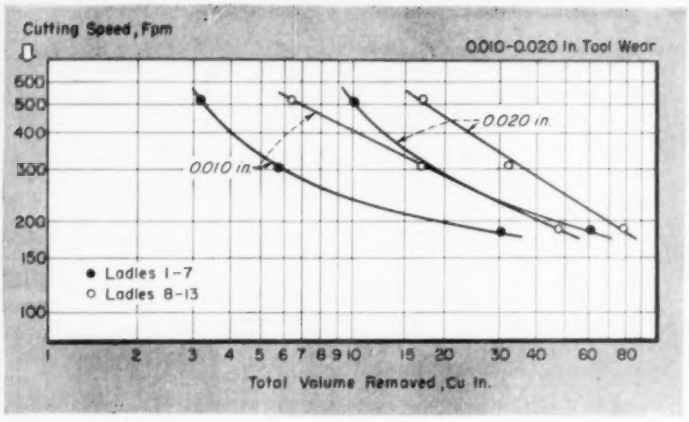


FIG. 2 . . . **TOOL WEAR** was less with irons treated with additions of Ferro-Carbo (ladles 8-13) than irons made by cupola practice A (ladles 1-7). Work condition: as-cast surface. Drag and cope surfaces were machined

Machinability of high-phosphorus irons

Most volume users of castings have required maximum phosphorus of 0.35% or less, for machinability reasons. Now test data support the conclusion that high-phosphorus irons, suitably treated, have excellent machining characteristics. Thus, more foundries, especially those in the South, will be in position to meet the demand for machinable castings

By EDWARD A LORIA, Senior Engineer, Research & Development Dept, THE CARBORUNDUM CO

Most machinability testing on irons is done with a limited objective. The shop or investigator wants to know the response of these materials to drilling, tapping, milling or turning, as the case may be, in order to solve a problem. But in testing high-phosphorus irons produced in two ways, we decided to apply four testing procedures. These were: tool-wear and constant-pressure turning methods, drilling, and tapping. The tests were made to simulate commercial machining conditions on critical casting sections. By correlating the data in this manner, the shop has the information at hand to use treated high-phosphorus irons in an efficient manner.

Of course, some work on the subject had been done previously. Field and Stanbury[1] reported, on the basis of carbide milling tests on gray iron with a 0.35% phosphorus content, that the presence of approximately 5% steadite (iron-iron phosphide eutectic) in a given pearlite-graphite distribution decreases tool life slightly at high machining speeds (1000 fpm), but actually increases tool life at low speeds (below 500 fpm). Austin[2,3] employed various ladle-addition agents to improve machinability of gray irons containing from 0.60 to 0.90% phosphorus. Principally by means of drill-penetration tests and also carbide tool-life turning tests, he showed that a desulphurization-zirconium addition will make a 0.65% phosphorus iron equivalent to an untreated 0.25% phosphorus iron.

The conventional way of stating the analysis of cast iron as though the phosphorus were present in the free or uncombined state is likely to be misleading. For example, a phosphorus content of 0.50% actually means a steadite content of about 5% by volume. This is an appreciable quantity, because this micro-constituent is comparatively hard and might be expected to impair machining properties. Consequently, the automotive industry and other large-volume consumers of castings have not accepted, to any great extent, castings containing more than 0.35% phosphorus. However, as will be shown, a 0.50% phosphorus iron can be produced to meet the usual machining requirements and have good physical properties. This is done by proper selection of charge materials and balance of the carbon

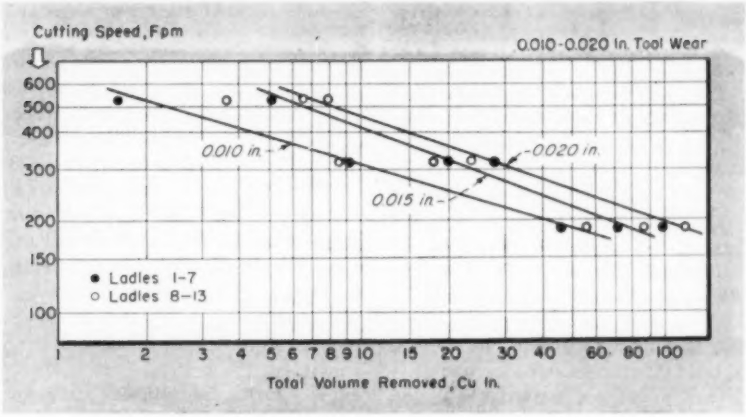


FIG. 3 . . . PRE-MACHINED TEST RINGS showed little if any advantage in respect to tool wear as compared to the as-cast surface. Microstructure is apparently uniform from the as-cast surface to ⅛-in. depth

improved by ladle additions

and silicon contents of the iron.

It is becoming increasingly evident that a single reliable machinability index may never be found. In different types of machining, such as turning, drilling, reaming and milling, different irons and different structures may stand in different orders. Nevertheless, machining tests standardized and held constant in every detail except for the work material offer an empirical approach to this complex problem. These have been applied in the present study for a series of southern high-phosphorus irons, and comparisons were made with northern low-phosphorus irons of otherwise similar chemical analysis.

Four procedures evaluate the production rate and cutting energy criteria of machinability. They comprise tool-wear turning tests on individually cast rings, constant-pressure turning tests on arbitration bars, drill-penetration tests on small rectangular bars and tapping-energy tests on small lock-nut castings. All specimens were produced by balanced-blast cupolas using uniform raw materials and necessary operational quality control. All test specimens fell within 3.40-3.50% total carbon, 1.80-1.90% silicon and 0.45-0.55% phosphorus, a range that provides properties comparable to northern low-phosphorus irons.

TOOL-WEAR MACHINABILITY TESTS

The testing procedures used by Battelle Memorial Institute were similar to those described previously.[4, 5] Rings of 7 in. ID, 9 in. OD, and ½ in. thickness were individually cast in core sand to eliminate the variable effect of moisture on the surface structure of green-sand casting. Rings were placed in a lathe, Fig. 1, and machined on the parallel faces using single-point Carbology grade 44A tools.

Initial tests were made on the as-cast surface of the rings at 185, 315 and 512 fpm. Tests were made alternately on drag and cope surfaces at a nominal depth of cut of 1/16 in. (allowing for dimensional inaccuracies in casting) and feed of 0.0102 ipr. Tool-wear measurements were taken after each cut except at the slowest speed. Because of the low wear rate at 185 fpm, it was found more satisfactory and convenient to measure tool wear after every two cuts. If no apparent chipping of the tool edge occurred, tool failure was considered to occur when the wear land approached 0.025 in. It was impossible to detect any variation in tool wear between cope and drag sides of the as-cast ring.

The rings, with 1/16 in. machined off the cast surface, were then used in a second series of tool-wear tests. The procedure described above was repeated in order to give a comparison of tool wear at a depth of ⅛ in. below the cast surface.

TOOL-WEAR LIMITS

All test results were plotted directly as tool-flank wear versus the number of rings cut for each of the three speeds. From these graphs, the quantities of metal removed corresponding to tool wear of 0.010 in. and 0.020 in. were calculated for each speed and material. The value of tool life for a given amount of wear can then be plotted against cutting speed, as shown in Figs. 2 and 3.

The charts reveal that this series of high-phosphorus gray irons are quite machinable when cast in a ½-in. thick ring section, and the data compare favorably with the best results obtained by this test method on low-phosphorus irons of comparable chemistry.[5] It was possible to remove a considerable volume of metal at 512 fpm before tool failure. In the 185 to 512-fpm machining-speed range, the 5% steadite had no detrimental effect on tool life. In fact, in accord with the results of Field and Stansbury[1], it might be said that the presence of this amount of steadite probably improved machinability in this speed range for the same reasons given in their paper. The Brinell hardness values for each batch of rings given in the table.

UNIFORM MICROSTRUCTURE

The relative abrasiveness of the cast surfaces on carbide tool wear is shown in Fig. 2. Many shop men believe that it is possible to alleviate the detrimental effects of the skin upon the cutting tool by taking a deep cut. But comparison of Fig. 3 with Fig 2 shows that there is little variation in tool wear rates favoring premachined specimens. This observation indicates

that the microstructure of these 0.50% phosphorus irons was uniform from the as-cast surface to the ⅛ in. depth.

At the low speed of 185 fpm, more metal was removed from the premachined rings for given tool wear. This finding lends some support to the work of Datsko and Boston[6], who observed that the casting skin was more abrasive than the interior structure when making HSS tool wear tests on turning 6-in. OD, 4-in. ID cylinders of low-phosphorus gray iron (3.25% TC, 2.28% Si, 0.25% P).

CONSTANT-PRESSURE TURNING

The constant-pressure lathe test developed by Battelle Memorial Institute provides another means of evaluating machinability for it gives information on tool travel for a constant feed load.[5] Even in a free-cutting material such as cast iron, specimens of different machining quality cut at different rates for constant surface speed, when a fixed lateral pressure is applied to the tool. Ratings of the tested materials hinge on the assumption that an iron with superior machinability will cut with a heavier feed than one of poorer machinability. Cold-drawn B-1112 steel is used as a reference standard with a machinability index of 100. The setup includes a device for recording the number of spindle revolutions R, during tool travel of 2 in. The tests were standardized at 140 rpm with a tool thrust of 81 lb for a ⅛-in. deep cut.

The 1.2 in. dia arbitration bars cast in green sand were first machined to 1.0 in. dia before testing. Individual machinability indexes for test bars of 0.50% phosphorus irons are comparable to those for 0.10 to 0.16% phosphorus irons of otherwise similar chemistry.[7] In the total carbon range of 3.40 to 3.50%, they fall smoothly along the trend line drawn for several of the latter irons, whose constant-pressure ratings varied from 148 to 154. A statistical study to determine the effects of variations in chemical composition on machinability rating showed that changes in total carbon content exerted the greatest influence on the constant-pressure index.

DRILL-PENETRATION TESTS

The penetration test on a drill press, in which a standardized drill works under a constant load and speed for a definite time, provided a third method of evaluating the relative machinability of the two types of iron. Ths method assumes that the drill makes a hole with a depth proportional to the machining properties of the material tested, and has been adapted successfully for the testing of gray iron by Southern Research Institute. Tools used were a ⅛-in. pilot drill and a ⅜-in. test drill; a point angle of 118° and a cutting angle of 135° being used on standard two-fluted twist drills. The drills operated at 487 rpm and a point pressure of 50 lb. Test specimens were cast in green sand in the form of rectangular blocks about ¾ in. x ⅞ in. cross section and 4 in. long.

The constancy of conditions, including drill sharpness, was checked before and after testing each specimen. This was done by making a series of tests on a standard test bar of predetermined machinability. Maintenance of drill sharpness is a critical factor. However, with reasonable care in sharpening with a precision drill-grinding fixture, it is possible to get satisfactory reproducibility. The test drill was resharpened whenever the rate of penetration in the standard test bar fell below a predetermined level.

The test procedure consisted of the following steps:

1. Drill pilot hole through specimen.
2. Locate test drill on pilot hole and, with deadweight loading device operating, start drill.
3. After test drill had penetrated about ⅛ in., begin timing; clock accurately the interval required for test drill to penetrate exactly ½ in.
4. Record rate of penetration in seconds per inch, and convert to millimeters per minute.

Drill penetration averages are reasonably consistent; ranging from 50.2 to 55.8 mm penetration

HOW HIGH-PHOSPHORUS IRONS RESPONDED TO MACHINING TESTS

Ladle No.	Chemical Analysis, %							Brinell Hardness		Constant Pressure Lathe Index*	Drill Test Penetration mm./min.	Tap Test Power kw
	TC	Si	Mn	S	P	GC†	CC‡	Rings	Bars			
1	3.49	1.84	0.43	0.08	0.54	2.73	0.76	229	197	156	51.0	0.69
2	3.47	1.80	0.40	0.08	0.52	2.70	0.79	241	207	154	50.8	0.65
3	3.41	1.82	0.45	0.09	0.53	2.59	0.82	248	229	142	50.2	0.92
4	3.43	2.08	0.40	0.09	0.49	2.69	0.74	229	207	151	50.4	0.67
5	3.40	1.89	0.42	0.08	0.50	2.59	0.81	241	217	146	50.2	0.73
6	3.45	1.85	0.45	0.08	0.52	2.67	0.78	241	217	146	50.8	0.66
7	3.44	1.90	0.46	0.09	0.50	2.80	0.68	235	207	157	54.7	0.64
8	3.48	1.84	0.44	0.08	0.50	2.68	0.77	235	217	151	55.8	0.64
9	3.45	1.82	0.40	0.09	0.49	2.79	0.71	229	207	—	52.7	0.66
10	3.50	1.80	0.41	0.09	0.49	2.82	0.67	241	197	158	54.4	0.64
11	3.49	1.90	0.43	0.09	0.50	2.63	0.80	217	207	144	51.4	0.67
12	3.43	1.90	0.40	0.09	0.50	2.84	0.69	229	197	158	53.6	0.64
13	3.53	2.08	0.42	0.09	0.50	—	—	229	229	—	—	—

* *B 1112 steel = 100*
† *Graphic carbon*
‡ *Combined carbon*

Ladles 1-7 taken from cupola melting practice A, and ladles 8-13 from cupola practice B (employing Ferro Carbo briquettes)

per minute. These values compare satisfactorily with those obtained for low-phosphorus irons of similar analysis and section size.[8] For example, a 0.26% phosphorus iron with 3.46% total carbon and 2.08% silicon, cast in a more massive and heavier (1.5 in.) section had only a slightly higher rating of 58.7 mm penetration per min.

TAP-TEST MACHINABILITY

Because of its simplicity and adaptability to simple testing equipment, a $\frac{3}{8}$-in. lock nut was chosen as the test specimen and cast in green sand. Small mass of the specimens made them sensitive to chilling. The cored hole of each specimen was sized to remove any small irregularities caused by metal penetration of the sand core. Great care was exercised in this operation to prevent the removal of the cored surface or "skin." Each specimen was therefore prepared without destroying conditions encountered in production operations.

In this test, machinability is considered as the resistance like material offers to metal removal. Such resistance is reflected in the peak-load energy in kw required to rotate a given tap at a given rate of rotation (in this case 41 rpm). The average power consumption ranged from 0.64 to 0.74 kw. These results show that 0.50% phosphorus irons are machinable even in thin sections, and at only 15-30% more power than the average value of 0.54 kw obtained on completely annealed, malleable iron specimens.

The major importance of the total carbon and silicon contents in controlling the graphite-combined carbon relationship and hence machinability of cast iron is well known. Graphite promotes free-cutting in much the same manner as manganese sulphide improves the machinability of steel. Increasing amounts of combined carbon (carbide) indicates a harder and less machinable matrix. How changes in the relative amounts of these elements (particularly combined carbon) affected the machinability rating irrespective of the test method is evident in the results.

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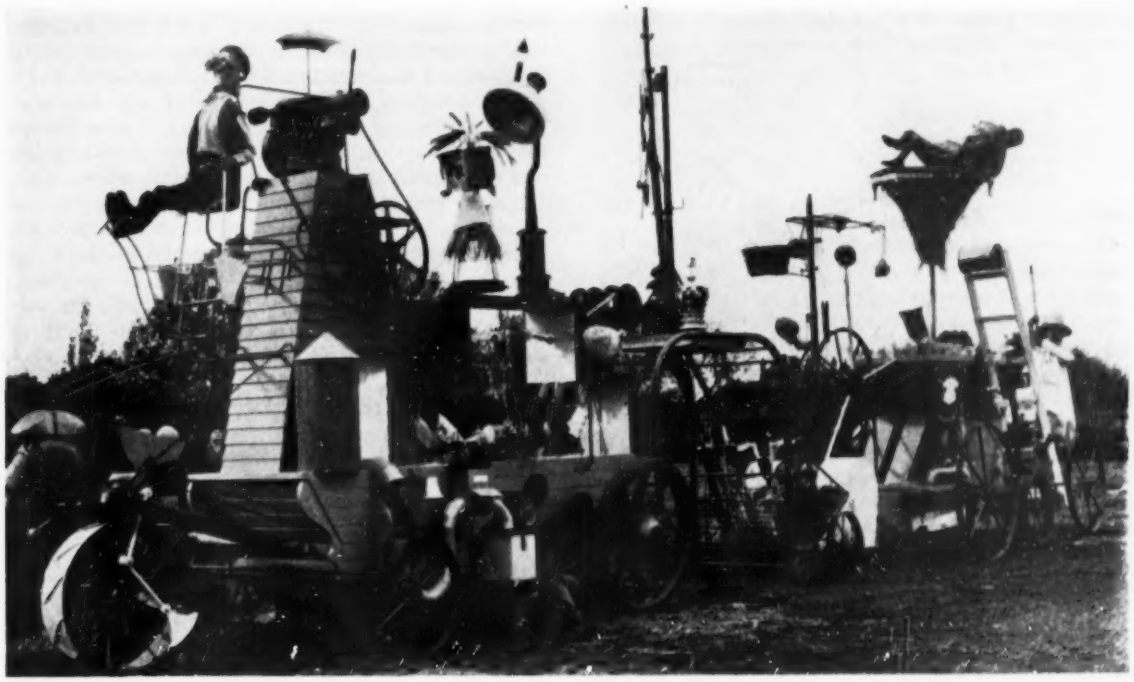

REVOLUTIONARY! HAW INSPIRING! These were but a few of the comments that greeted the appearance of the Hogmuddle All-Purpose Rotatory Niggler and Fidgeter at England's recent Bath and West agricultural show. Designed by famed British cartoonist Rowland Emett, the machine does everything and then some, thus "tidying up the countryside immeasurably." Among its features: a resident hen, an automatic carrot rejecter, a revolving feather bed that enables the gentleman farmer to survey farm work without moving, a hedge trimmer that also cuts the farmer's hair, and an arch that permits the passage of hunts, both stag and fox. Machine is a unique way devised by Petters, Ltd, English farm machinery manufacturer, to show how its 10-hp air-cooled gasoline engines can power a wide variety of farm implements. The Hogmuddle mounts the engine above the level of evening mists

Cope Talks on Draw Dies . . . III

FOLLOW THESE PRINCIPLES IN

Keep in mind clearances, radii and permissible reductions. Then try to build

BY STANLEY R. COPE, President, ACME SCHOOL OF DIE DESIGN ENGINEERING

Ultimate strength of most metals is reached when one attempts to draw a shell to a diameter equal to half the blank diameter, or to a depth equal to the shell diameter. If one assumes the diameter of the blank to be 100%, the above reduction in diameter of the blank is 50%.

Theoretically, it should be possible to reduce the diameter of a blank 50%, if the metal is of uniform quality, either a double-action or a hydraulic press is used, and all other conditions are favorable. In practice a 50% reduction not possible because of the differences in metals and mechanical difficulties. Attempts to reduce blanks 50% result in either complete failure or breaking 40 to 60 shells out of every hundred.

To avoid trouble and excessive breakage, shells should not be drawn to a depth greater than 2/3 or 3/4 of their diameters nor should blanks be reduced in diameter more than these percentages:

Material	Maximum Reduction
Steel and tinplate	45%
Brass and copper	45%
Aluminum	40%
Zinc	35%

CONSTANT SYSTEM

The minimum diameter to which a shell can be drawn from a blank of given diameter can be computed from the above table or by the constant system. The latter is more scientific, because it takes into consideration the thickness of the material. For the same quality of work, the ratio of the shell diameter to the blank diameter is not constant for different thicknesses of metal.

The constant system should be used for drawing steel, tinplate, brass and copper, when using double-action or hydraulic presses, or single-action presses equipped with air cushions.

The smallest diameter to which a shell can be drawn from a flat bank is found by this formula:

$$d = \frac{K \times D}{100 - 0.635\,D}$$

where: D = blank diameter

d = mean diameter of shell (center of one wall to center of opposite wall)

K is a constant:

Thickness of Metal in, T	K
0.016 to 0.018	64.5
0.02	61.5
0.022 to 0.024	59.5
0.028	57
0.030	53
0.060	50
0.120	51

Example: Assume D = 8¾ in.; T = 0.023 in. Then K = 57. And

$$d = \frac{57 \times 8.75}{100 - (0.63 \times 8.75)} = 5\ 9/32 \text{ in., approx.}$$

BOTTOM AND DRAWING RADII

To draw a shell to maximum depth in one operation, the inside bottom radius should not be less than 1/16 in. or four times the metal thickness, whichever is greater. Otherwise, shearing stresses may cause the shell to break. If a shell is not drawn to the maxmium depth the bottom radius may be practically square for very shallow shells, but should be increased in proportion for deeper shells (Fig. 1).

The drawing radius (the size of the arc over which the metal flows into the die) is also important. If this radius is too small the metal will stretch and may either thin out or tear. If the radius is too large the blank will be free from the control of the pressure pad. This may cause the shell to wrinkle near the open end, and subsequently overload the die.

Minimum and maximum drawing radii for different thicknesses of metal are tabulated. Radii for drawing thicker metal should be increased in pro-

DRAWING RADII FOR DIFFERENT THICKNESSES OF STOCK

THICKNESS OF STOCK		RADIUS OF DRAWING EDGE, IN	
U S G	In	Min.	Max.
16	0.0598	1/4	3/8
17	0.0538	1/4	3/8
18	0.0478	1/4	3/8
19	0.0418	3/16	5/16
20	0.0359	3/16	5/16
21	0.0329	3/16	5/16
22	0.0299	3/16	5/16
23	0.0269	3/16	9/32
24	0.0239	3/16	9/32
25	0.0209	3/16	9/32
26	0.0179	5/32	1/4
27	0.0164	5/32	1/4
28	0.0149	5/32	1/4
29	0.0135	5/32	1/4

DIES FOR SHALLOW SHELLS

your dies according to the proved designs illustrated

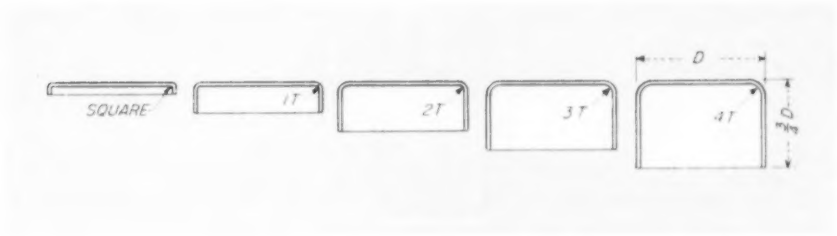

FIG 1 . . Bottom radius of shells should bear a relationship to depth. Permissible range is square for very shallow shells to not less than 4T for deep shells

portion. Minimum radii tabulated should be used to draw small shallow shells that are not too deep maximum radii for either large work or small shells to maximum depth.

When either the bottom radius or the drawing radius of a shell, or both, are too small to permit drawing the shell without breaking it, the shell must be drawn slightly deeper and with larger radii. The radii are then "sharpened," or set, in a setting die, (Fig. 2.)

Construction and operation of a setting die are simple. The shell, shown at *A*, drawn with larger radii and slightly deeper than the finished shell, is located over punch *B*. It rests on pressure pad *C*, which is normally held about ¼ in. below the top of the punch by pressure pins *D*. When the press is tripped, upper die *E* slips over the shell and pushes pad *C* down. The radii are set to the correct size and the shell is stamped to the proper height when the die bottoms at the end of the stroke. It is necessary to draw the shell slightly deeper in the first operation to provide enough metal for filling out corners. Height of the first shell is found by trial.

CLEARANCES

Regardless of the pressure applied to a blank, the side walls near the open end of a shell tend to thicken slightly during the drawing operation. If extra space, in addition to that for the metal thickness, is not allowed between the punch and the die for this normal increase in wall thickness, the shell will be ironed slightly. The two methods previously given for computing the maximum reductions for shells are based on free drawing, with ample clearance.

Ironing increases the load on the bottom of the shell, and reduces considerably the depth to which a shell can be drawn in one operation. For example, if it is possible to draw a shell with normal clearance to a diameter equal to 55% of the blank diameter (45% reduction), the shell can be drawn to 60% of the blank diameter, (40% reduction) if no extra space is allowed in the die. In other words if the die is made "metal-to-metal," which is the term used when only enough space for the metal itself is allowed between punch and die, the reduction in diameter should be about 5% less.

When a stamping is drawn complete in one op-

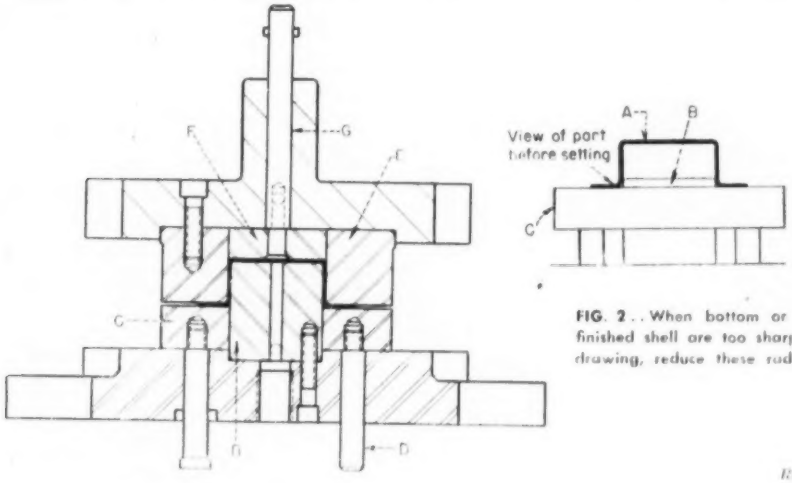

FIG. 2 . . When bottom or drawing radii of a finished shell are too sharp for single-operation drawing, reduce these radii in a "setting" die

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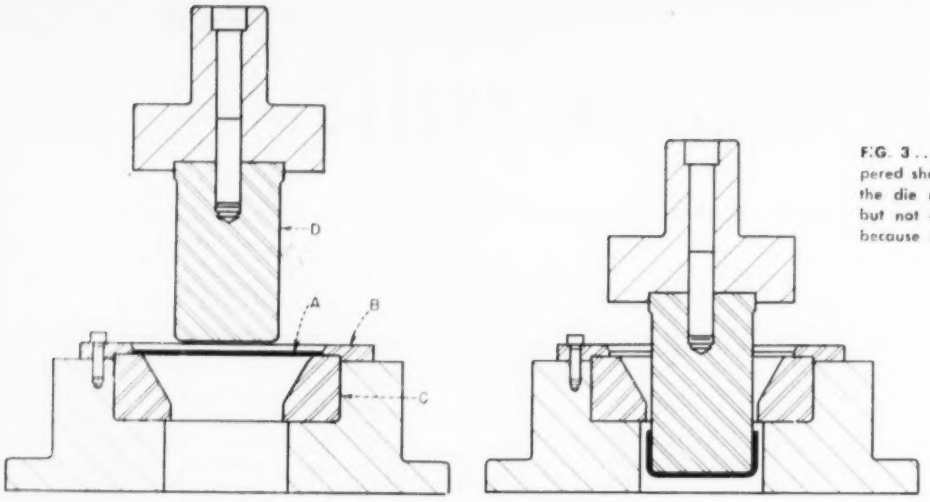


FIG. 3 . . Folding a blank into a tapered shell and pushing it through the die ring is used for cupping, but not often for a finished shell because of trouble from wrinkling

eration, and is not to be sized or redrawn in succeeding operations, the die should be made metal-to-metal. If clearance is allowed, the side walls will be tapered and may have slightly wavy appearance. For example, consider a shell which has an OD of 3½ in. and is drawn from 0.0598 in. stock. The die hole should be machined to the same diameter as the shell, and the diameter of the punch should be two thicknesses of stock less, or 3.3804 in.

If the diameter of a shell can vary ±0.010 in. or more; or if the shell is to be sized or redrawn in a succeeding operation, the difference between the diameters of the drawing punch and the die should be 2.2 times the thickness of stock.

No attempt is made to show the actual clearance on a die drawing. The space between the punch and die is always drawn equal to one metal thickness. Clearance is taken care of by the dimensions.

DESIGN OF DRAWING DIES

There are several types of dies used to draw flat blanks into shells and other shapes. The proper choice depends upon size and shape of the shell, thickness and kind of material, number and nature of the operations used, the number of pieces to be made, and the type of press available.

Two general principles are used in drawing metal; with and without blank-holding pressure. Dies to illustrate these principles are shown in Figs. 3 and 4. In Fig. 3 is shown a type of die used to draw shallow shells from thick stock without blank-holding pressure. This method is commonly used for "cupping" the first shell in a series of operations such as for making shell cases.

Blank *A* is placed in ring *B* and rests on a small flat portion around the mouth of die *C*. This flat portion should not be more than ⅛ in. wide. When

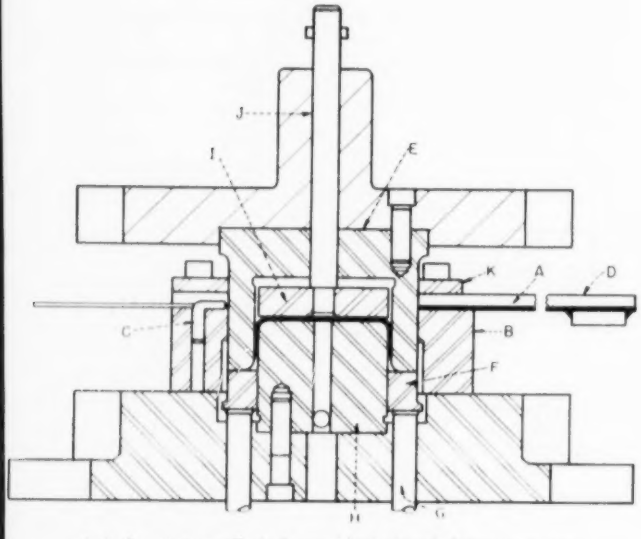


FIG. 5 . . Most small shells are blanked and drawn in a combination die. Pressure pad *F* controls the drawing action

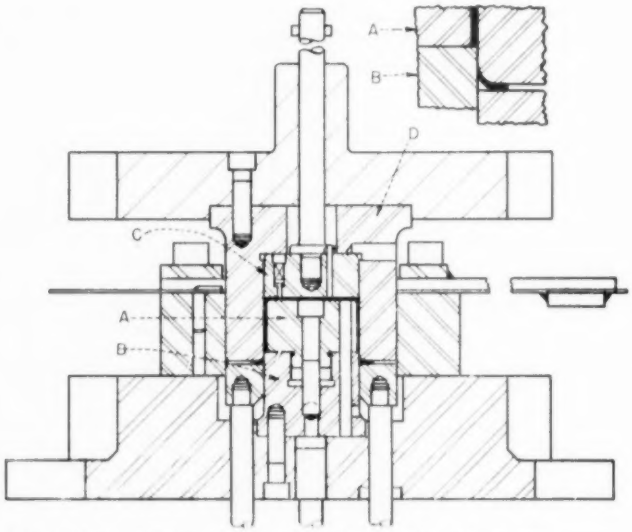


FIG. 6 . . Pinch trimming of thin-wall shells of various shapes can be done in a combination blanking and drawing die

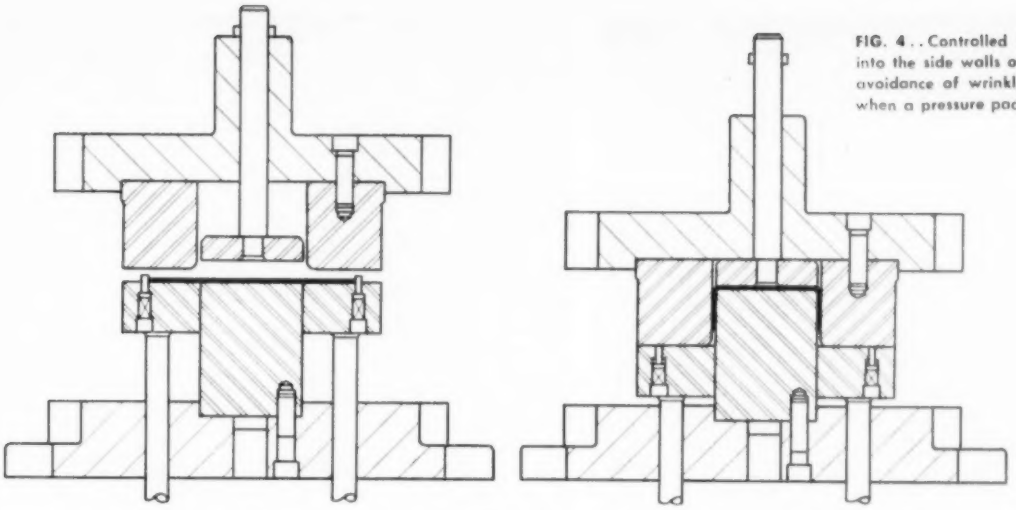


FIG. 4 . . Controlled flow of metal into the side walls of the shell and avoidance of wrinkles are secured when a pressure pad is used

punch *D* descends, it folds the blank into a shell with tapered side walls and then transforms this tapered shell into a straight-walled shell by pushing it through the die. The shell is stripped on the sharp edge of the die when the drawing punch returns. Dies of this type are not used often for drawing the common run of shells, because success of the operation depends entirely upon ability of the metal to resist wrinkling. It is not often possible to predict whether the shell proportions are correct to resist wrinkling. For this reason shells are usually drawn with the aid of a pressure pad, (Fig. 4).

COMBINATION DIES

The majority of small shells are blanked and drawn in one operation in combination dies similar to that shown in Fig. 5. The operation of the die is as follows: Strip *A* is placed on die block *B* and is pushed across the die until it strikes stop *C*. Holding the strip firmly against stock guide *D*, the operator trips the press, which causes punch *E* to descend and cut the blank to the correct diameter (previously developed by trail). The blank is gripped between blanking punch *E* and pressure pad *F* and continues to travel downward. ressure pad *F* is normally held flush with the top of die block *B* by pressure pins *G*.

When the blank contacts drawing punch *H* it is drawn from between the blanking punch and pressure pad into the desired shape. Punch *H* is located ¼ in. below the die block to permit the blank to be cut without interference, and to provide metal for sharpening the die.

When the slide of the press ascends, the shell is stripped from the drawing punch by pad *F*. The work travels upward in upper die *E* and is ejected near the top of the stroke by knockout plate *I* and knockout rod *J*. Strip *A* is prevented from rising by stripper *K*. The stripper is cut away in the back to provide a clear path for the shell.

PINCH TRIMMING

When metal thickness does not exceed 1/32 in., the shell can be produced complete in one operation in a combination blanking, drawing and pinch-trimming die similar to that shown in Fig. 6. The design and construction of this die is very similar to the die shown in Fig. 5, except that an additional cutting member is provided in the lower half of the die to trim the shell to length near the end of the stroke. Drawing punch *A* is machined to a height equal to the inside depth of the shell. It rests on trimming steel *B* and is located in that member by a short tail, or extension, that fits into a hole. The hole in steel *B* should be considerably deeper than the length of the tail to permit sharpening the trimming steel when it becomes dull.

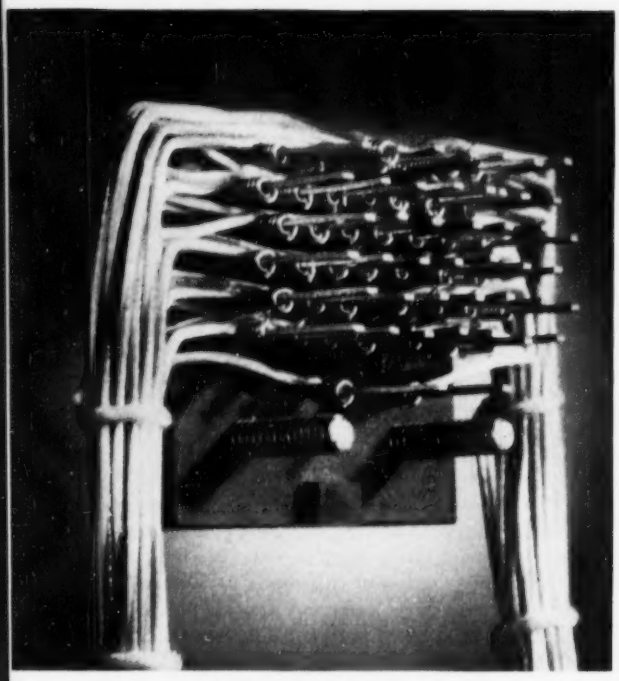
Steel *B* is machined to the shell OD. It is provided with a small shoulder and is fastened to the die holder by three screws.

Knockout plate *C* is arranged to bottom in order to hold the shell to the correct height and to prevent upper die *D* from sliding down too far over the trimming punch. The pressure pins are screwed into the pressure pad, and one pin is provided with a head to prevent the pad from rising out of the die. A shoulder cannot be turned on the pad for this purpose because it would be necessary to provide clearance for it in the die block. The upper blanking punch must fit in the die block accurately and be supported to prevent it from springing outward when the ring is pinched off the shell. If the blanking punch is permitted to spring, the ring will not be completely sheared off.

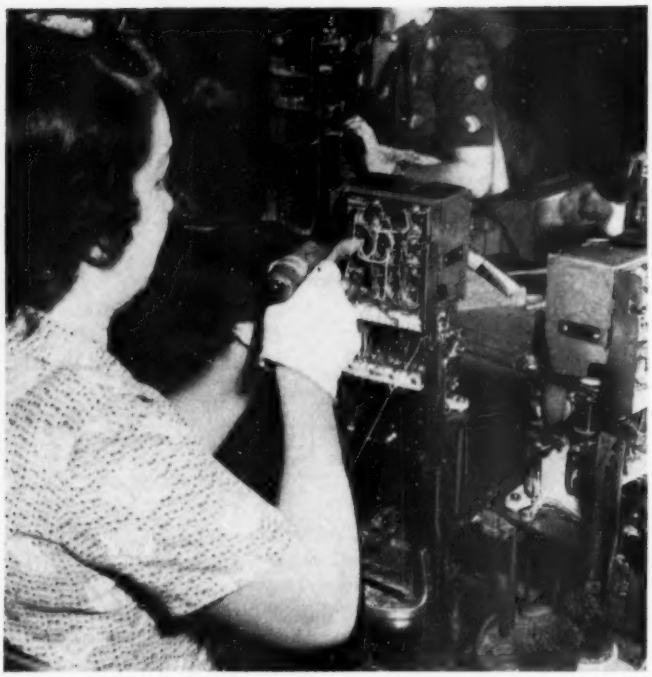
Shells with practically any shape can be drawn and pinch trimmed by this method, but the method is more satisfactory for trimming round work.

When the metal being drawn is very thin, or the shell is shallow, thus necessitating the use of a thin and delicate blanking and drawing member, a combination die equipped with a spring stripper should be used. The spring stripper descends 1/32 in. ahead of the blanking and drawing punch, and it smooths and flattens the strip so that the delicate punch will not have to do this work.

Part IV of Mr Cupe's series will appear in an early number.



SMALL CENTER-TO-CENTER SPACINGS between terminals make possible as many as 200 connections (three or four can be made on each terminal) on each sq in. of terminal block. Wire size is 26 gage



PNEUMATIC WRAPPING GUN does assembly job faster, easier, and better than soldering iron. Fixturing and setup work on production line are simplified because terminals can only be worked upon from the end

Bell wraps solderless connections for

BY CHARLES EMERSON, ASSOCIATE EDITOR

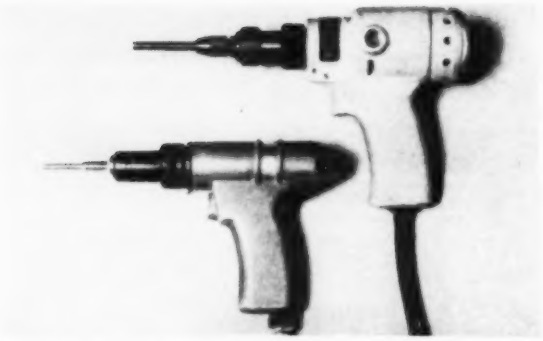
Hand-made electrical connections have been a rising cost factor in the communications industry for several years — the main objection being to soldering. Solder splashes, wire must be clipped, heat and space are problems, and the job takes time and skill. With all these disadvantages, and despite the fact that soldering remains the best method of making electrical connections in many applications, little has been done to improve the process.

To overcome these objections to soldering in high-production work. Bell Telephone Laboratories and Western Electric Co have come up with a wire-wrapping system as a result of five years of laboratory test and research. Wire wrapping is actually a type of pressure connection, though it is more adaptable to high-quantity production than other pressure methods in use at present. The joint is made mechanically, which eliminates operator judgment from the process, and it lends itself to mechanized wiring—an objective long sought in the industry.

It works this way: A stripped wire is wrapped around a blade terminal with a hand-held gun-shaped tool. For most practical purposes, six wraps are sufficient, which produces 24 pressure joints, one at each corner of the terminal. Pressure at each corner is initially 30,000 psi, dropping off at extreme temperatures to about 15,000 psi over the life period of the joint. The wire relaxes slightly during this time, but this loss is largely made up by molecular adhesion between the metals of the wire and terminal. The wrapped wire causes the terminal to twist somewhat, and the twist unravels as the wire relaxes, which tends to hold pressure in the connection.

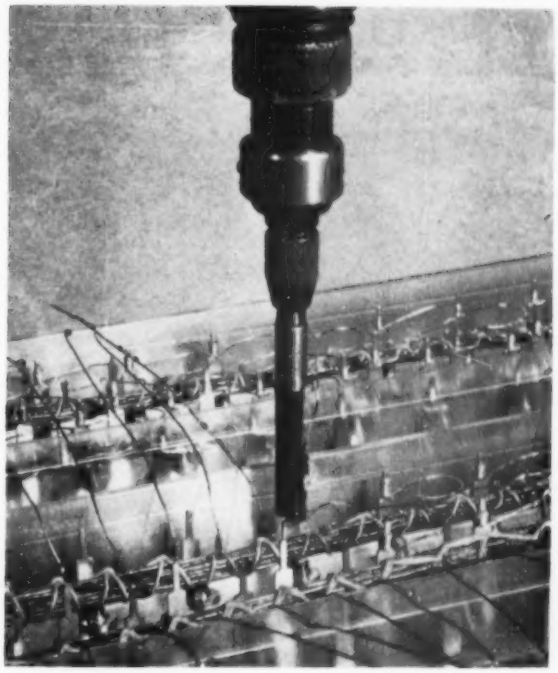
The tool that does the connecting consists of a rotating spindle within a fixed protecting sleeve. Drive for the spindle can be electrical, pneumatic, or even by hand pressure. There are two holes in the end of the spindle; a central hole that slips over the end of the terminal, and an off-center hole into which the bared wire is inserted. As the spindle rotates, the wire is wrapped around the terminal, making a firm metal-to-metal joint.

Little manual effort is required to operate the power tool, and the absence of heat and objectionable fumes has made the job easier for the worker. Each spindle will generally handle more than one size of wire and terminal, with other spindles available to



ELECTRIC TOOL (TOP) is slightly larger and heavier than air model; but both contain same working spindle and flared outer sleeve

WRAP STARTS with end of stripped wire inserted in hole in spindle, and bent over notch in sleeve. Tool is placed over terminal, and spindle rotated. Completed connection forces tool off terminal



NEWEST ADAPTATION OF WRAPPING TOOL includes stripping band (close to tip) that skins special plastic insulation off wire prior to wrapping, thus saving the time normally required for stripping by hand

joint economy

permit interchangeability for broad requirements.

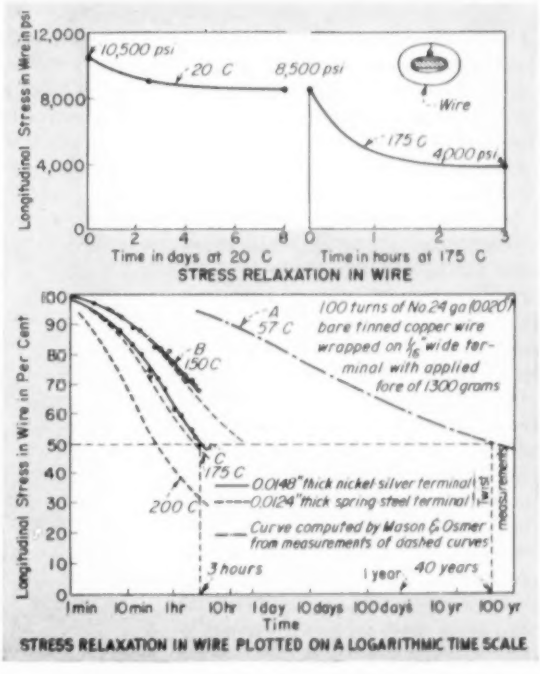
The whole operation is fast—at least twice as fast as soldering, and is therefore economical. In addition, no solder is required; a further saving.

Stripping force required for disconnecting the wire is about 10 lb, which is enough to hold the connection against considerable mechanical flexing, but low enough to allow easy tear-down, when required, without special tools.

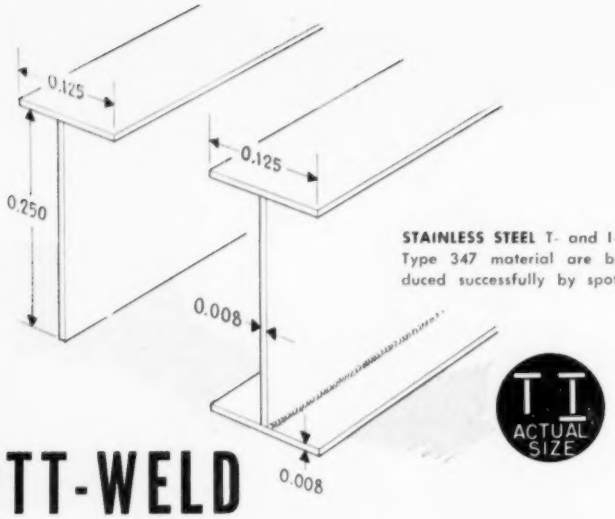
Another feature of the wire wrap is that more connections can be made in a given space than by soldering. This is important because of the trend toward miniaturization.

Some idea of what this new connecting method may mean to the telephone industry can be gathered from the fact that a crossbar central office of 10,000 lines may have as many as 2,600,000 connections. Production time saved on this number of connections is no small matter—not counting the savings in solder costs.

Although Western Electric does not plan to produce the tool, it will be made available to electrical manufacturers through licensed builders of portable air and electric tools.



STRESS RELAXATION OVER 40-YEAR PERIOD, determined by accelerated life tests, shows initial drop and gradual taper afterward. Tests showed that 3 hrs at 175 C equalled 40 years at 57 C



STAINLESS STEEL T- and I-beams of Type 347 material are being produced successfully by spot welding

HOW TO BUTT-WELD 0.005-in. STAINLESS

It looked impossible, but it had to be done . . . And here's how Navy technicians solved the problem of butt-welding 0.005- and 0.008-in. stock by spot welding

BY MARVIN S WEINSTEIN, Physicist, U S NAVAL ORDNANCE LABORATORY White Oak, Silver Spring, Maryland

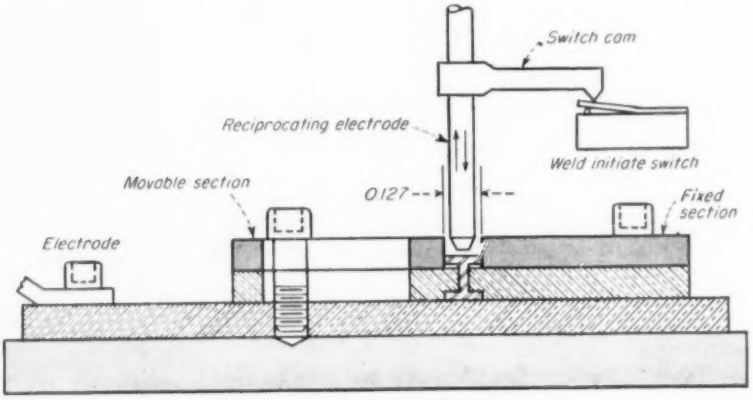
ONE of the first problems faced by the United States Naval Ordnance Laboratory in construction of a model submarine was that of welding thin strips of stainless steel in an abutted position to simulate structural members such as T- and I-beams. Specifications called for a weld with a 1/32-in. maximum fillet radius, right-angle joints, and centering of the flange material. Because several hundred feet of miniature T- and I-beams were required, semi-automatic welding techniques were essential. It soon became apparent that conventional methods would not be satisfactory.

The major problem was prevention of distortion and burning of the relatively thin material by excessive heat. The most promising method appeared to be the condenser-discharge technique. This has long been used for precision welding, particularly in making radio tubes, and has several distinct advantages for this type of work. Not only can the welding heat be accurately controlled with excellent reproducibility but, as it is obtained by discharging a bank of capacitors, the time required to produce a weld is kept to a minimum. In this application, weld time is about 0.005 sec.

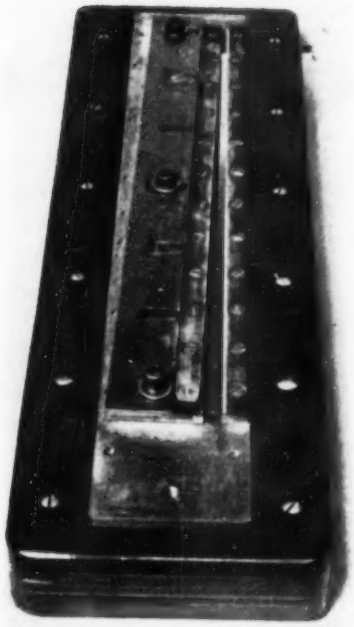
Successful use of condenser-discharge techniques requires adequate jigging for the particular job. In many cases this entails a negligible amount of work but, for welding in an abutted position, costly tailor-made jigs are required. An accompanying illustration illustrates the type of jig designed for the fabrication of a T-beam.

The web material is clamped as shown between the fixed and movable sections. The copper strips serve a dual purpose:

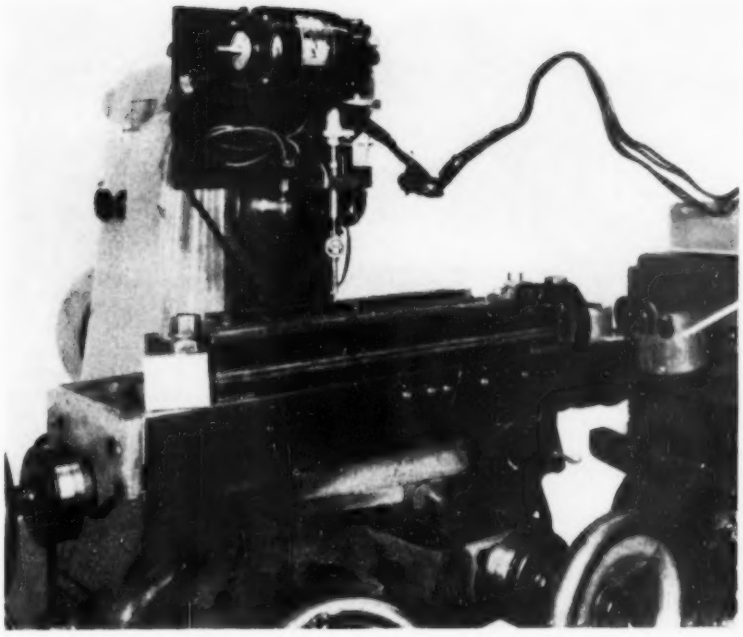
1) They support the web along its entire length and prevent buckling when electrode pressure is applied to the flange.



WELDING FIXTURE for T-sections is built of copper and bakelite. Movable section permits current to flow to both sides of web to equalize the weld



WELDING FIXTURE for I-beam. Part is made first into a T, then turned over in some fixture for attachment of second flange. Copper is undercut to permit passage of flange



SPOT-WELDING SETUP for short runs is made by mounting reciprocating electrode on the overarm of a milling machine. Table feed permits even spacing of spots

2) They serve as the web electrode with the following important features:

(a) Contact is made to both sides of the web tending to equalize the weld.

(b) They provide a large contact area which minimizes burning. A certain amount of contact pressure is required to reduce the electrical resistance between the electrode and the material. If small electrodes are applied across the web, for example $\frac{1}{8}$-in.-dia tips, the high concentration of heat across the web material and the resultant plasticity of the steel causes an outward flow, or material flash, resulting from the electrode pressure, leaving a hole about the size of the electrode tip in the web.

(c) It is convenient to have the web electrode fixed so a series of closely spaced spotwelds along the length of the T can be obtained by moving the jig under a reciprocating flange electrode.

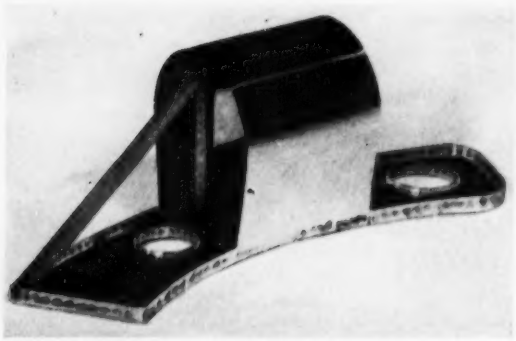
The Bakelite section positions the flange material and insulates it from the web electrodes. The edge of the Bakelite is stepped back slightly to insure good contact between the web and its electrodes. The over-all dimensions are such that the web strip protrudes about 0.002 in. above the Bakelite to insure good contact between web and flange.

T-BEAM at *a* before deformation; at *b*, with 180° twist, at *c* twisted through 720°, then straightened back. Although there is considerable deformation of base material, no weld failures occurred

RECIPROCATING ELECTRODE

For semi-automatic operation, the jig should be bolted to a movable platform and, for short runs, a milling-machine table equipped with automatic feed is convenient. The reciprocating electrode can then be bolted to the frame in place of the conventional vertical head. Any method of causing the reciprocating electrode to move in a piston-like fashion is satisfactory, provided the electrode is spring or bellows loaded. A spring has an advantage over a bellows in that the maximum pressure applied to the flange can be controlled by moving the table up or down. This is convenient because proper pressure is required to produce a good weld and, for best results, should be determined experimentally. For the case in question, a maximum electrode force of about 5 lb was found satisfactory.

As the electrode moves down it comes in contact with the flange, and pressure is obtained from the spring loading. The weld initiating switch is automatically actuated shortly before maximum pressure is attained, thereby providing a



MODEL STRUCTURE fabricated from 0.005-in. stainless. Appearance can be much improved by cleaning welds with a small wire brush

PIPE MOUNT fabricated from four sections, using special jigging

HOW TO BUTT-WELD 0.005-IN. STAINLESS *continued*

short period of forging pressure. It is desirable to allow for some adjustment of the timing to determine the best cycle experimentally.

The diameter of the electrode tip is also of some importance. A large diameter results either in weak welds or in extensive burning of the web, depending upon the amount of heat used. A small diameter causes burn holes in the flange and considerable flash. For the T under consideration, a tip diameter of about ⅛ in., with the edge broken, has been found most desirable.

With the reciprocating electrode driven at the proper ratio with the table drive, a series of uniformly spaced spotwelds is obtained. For the T, a spacing of about 1/10 in. was found satisfactory. As the table moves continuously there is a certain amount of forward travel of the reciprocating electrode while the tip is in contact with the flange. This can be eliminated by introducing a small amount of play in the electrode mount so the electrode travels with the table while in contact with the flange, then springs back on the reverse stroke.

In early work, the reciprocating electrode was of copper. More recently, silver-tipped electrodes have been used with much better results. The contact resistance between electrode and flange is reduced considerably, thereby eliminating the hot spot and the resultant occasional flange burns. This permits an appreciable increase in the heat applied and results in stronger welds.

ELECTRONIC EQUIPMENT

Any type of high-quality condenser welding equipment is satisfactory. For the work described here, the Raytheon Weldpower Model No. 225 was used with excellent results. This equipment was set for a 50-microfarad capacitor bank and a charge voltage about 90% of maximum. The voltage setting is critical and variations of about 10% are usually sufficient to cause weak or burned welds.

COOLANT

If all the variables discussed above are carefully controlled, satisfactory welds will result. However, even when optimum conditions are found, frequent adjustment is required because of electrode wear and variations in material. It has been found that greatly improved welds in thin materials can be obtained if the weld is flooded with alcohol. The alcohol serves a two-fold purpose. (1) *Cooling*: Although weld time is about 0.005 sec, it takes considerably longer to dissipate the heat. The alcohol cools the material by rapid evaporation immediately after the weld takes place. (2) *Coating action*: The alcohol coats both the electrode and the material and reduces burning by keeping oxygen from the surfaces. This effect is of greatest importance in minimizing electrode wear.

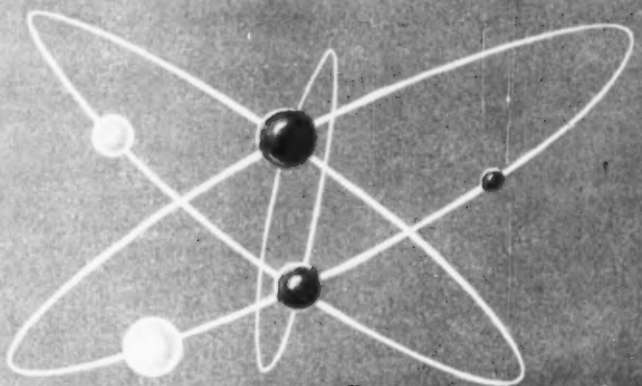
The major disadvantage of alcohol is its flammability. However, with material less than 0.015 in. thick, the operator can supply all the alcohol required with a medicine dropper, thereby minimizing the danger of fire. For thicker materials the problem of burning is of lesser importance and alcohol is not used.

WELD RESULTS

The material used was Type 347 stainless steel in a work-hardened condition. The weld produced is somewhat brittle and breaks clean under shearing stress. After annealing, however, the weld is quite strong. No attempt has been made to determine the strength of the weld but accompanying illustrations indicate the rough treatment the beams can withstand. Not only is there no evidence of weld failure, but the flange and web are still in proper alignment with each other.

With proper jigging almost any abutted configuration can be welded.

Through the combined use of condenser-discharge techniques, proper coolant, and adequate jigging, welding of thin stainless steel in an abutted position can be readily accomplished. Once the basic technique is mastered, the ability to produce an intricate precision-welded job depends entirely upon ingenuity in the design of specialized jigs.



how to understand ALLOY STEELS

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Alloy steel is just plain carbon steel to which one or more other elements are deliberately added to change some property or properties of the base material. These elements may affect the mechanical, magnetic, or chemical properties of the steel, depending upon the amount of element or the combination of elements used. Usually, two or more elements in one steel, which total a percent equal to a single additional element in the same steel, will have a greater effect on the properties of the base alloy than will the single element.

When the mystery of metallurgy, the cloak of highly-technical and scientific terms, is removed so that simpler words permit more readily understandable word pictures, alloy steels seem less complicated. Here we continue our series of reports written to simplify metallurgy for the non-metallurgist. Previous reports include "How to Understand Brass" (AM — Oct 13, '53, p 151) and "How to Understand Plain Carbon Steel" (AM — Mar 30, 1953, p 111).

The *Society of Automotive Engineers*, together with the *American Iron and Steel Institute*, have given a numerical classification to all of the commonly used steels and to most alloys not so common. In addition to this system, the *SAE* and the *AISI* have worked out a letter system to designate the process used to make a particular kind of steel. This report will discuss the relationship of alloy steel to plain carbon steel and then will describe the alloy properties in terms of the standard classification.

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plain carbon vs alloy steel

To serve as a refresher, as well as to establish a foundation for the discussion of alloy steel metallurgy, the principal conditions of plain carbon steel should be reviewed. With variations, these conditions are equally influential in determining the properties of alloy steel

Steel is an alloy of iron and carbon. The percent of carbon present determines the existence of the various steel microstructures (grain formations) at specific temperatures. Principal phases of steel are:

Austenite, a face-centered-cubic (fcc) lattice of iron, with carbon atoms between the iron atoms; carbon in solid solution with iron. This phase exists at high temperatures and strives, when cooled below 1333 F, to change to —

Ferrite, a body-centered-cubic (bcc) lattice of iron with relatively little carbon in the lattice and stable down to room temperatures. In addition, the austenite, depending upon carbon content also decomposes to —

Cementite (iron carbide, Fe_3C) in the form of orthagonal platelets which are extremely hard.

Also, it is *cooling rate* and not heating that produces the phases of steel. Slow cooling of a eutectoid carbon steel, 0.80% C, causes alternate lamallae (like minute fish scales) of ferrite and cementite to form. This structure is called *pearlite*. More rapid cooling causes the lamallae to be thinner, while a still faster cool produces a new structure, composed of ferrite and cementite, in extremely rough shapes and this is called *"upper bainite."*

The most rapid cool of *thin* sections produces a structure called *"martensite"* and this, like lower bainite, is in the form of lens-shaped needles. Martensite contains no detectable carbide, except when tempered.

As the cooling rate is increased, not only the structure of the steel changes, but the hardness increases with each new structure.

Alloy steel is plain carbon steel with one or more other elements added to change one or more property of the base material. While many properties can be added or changed in this way, hardness cannot be appreciably increased by alloying. Plain carbon steel can be made just as hard as any alloy steel.

EFFECT OF ALLOYING ELEMENTS

Addition elements can cause major changes in the mechanical properties of steel:

1. Increase the toughness, or ability to absorb considerable energy before fracture, and plasticity (ability to be deformed extensively without rupture) at low hardness. This is an important factor in workability and machinability.

2. Increase the hardenability (depth of hardening). For example: A 0.40% C steel bar, 1-in. dia, which would normally harden to a peripheral depth of only about ⅛ in. after water quenching from 1550 F would, if alloyed with 1.25% nickel, Ni, and 0.60% chromium, Cr, harden to a peripheral depth of ½ in., or all the way through. The degree of hardness would remain the same.

3. Decrease the hardenability of the steel.

4. Affect the rate of workhardening, or tendency of the metal to harden as it is coldworked (deformed at approximately room temperature). If a steel wire is bent back and forth, it will eventually break. When the steel is alloyed to *increase* the rate of workhardening, it can be broken with fewer bends.

5. Machinability of steel is improved by adding elements such as sulfur, S; lead, Pb; selenium, Se; tellurium, Te.

6. Some elements will decrease the tendency of a steel to warp while it is being quenched for hardening.

7. Alloying elements can improve the physical properties of the steel at high or low temperatures. Cutting tools for use at high temperatures and refrigerator expansion valves provide an example of each.

EFFECT ON MAGNETIC PROPERTIES

1. The addition of alloying elements can cause an increase in coersive force and the remanence of a steel. Basically the coersive force is that property which makes a magnetic material permanently magnetic. As the coersive force is increased, it becomes more difficult to demagnetize. Remanence is that property which gives the magnet strength. The greater this value, the more the magnet can pick up. Iron and low carbon steels have very low coersive forces but high remanences. These metals are known as "soft" magnets because they do not remain appreciably magnetic after they have been magnetized and the magnetizing force removed. However, while being magnetized they have great strength; can perform prodigious tasks of lifting, for example, steel scrap. The advantage here is that once the electric power is shut off, the magnetic pull of the soft magnet drops to zero and the load is released. Certain alloy steels have high coersive force with fairly high remanences. These form permanent or "hard" magnets and retain their magnetic pull even after the magnetizing force is removed. An application of these steels is the wire used for magnetic recording. (*AM*—July 21 '52, p124).

2. Addition elements also can decrease the magnetic properties of steel until they are nil. This is valuable where high strength and little, or no, magnetic response are needed.

EFFECT UPON CHEMICAL INERTNESS

1. Chromium, Cr, causes a decrease in the rusting of steel under atmospheric conditions.

2. Tungsten, W, and molybdenum, Mo, cause a decrease in attack on steel at elevated temperatures.

"S" Curves Show Characteristics

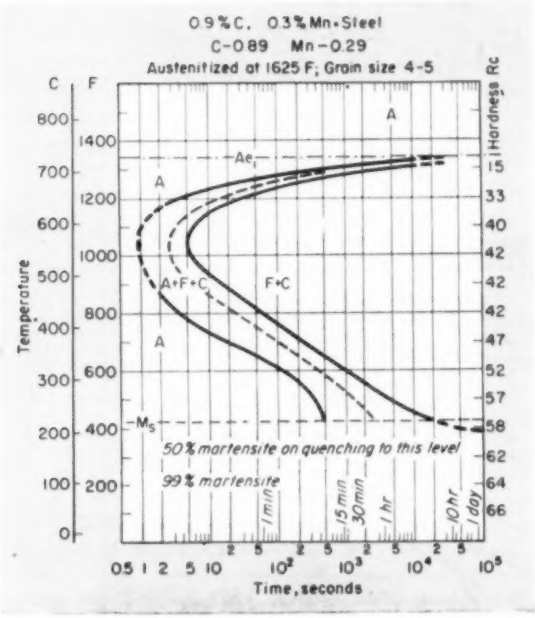


FIG. 1 . . SAE 1095, EUTECTOID CARBON STEEL, the simplest form of curve; consists only of two diagrams, one for the beginning and the other for completion of transformation

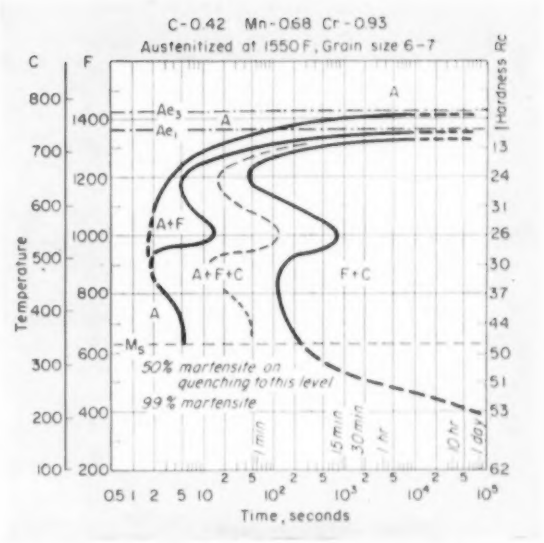


FIG. 3 . . SAE 5140, 0.9% CHROMIUM STEEL. Note small A + F field and small gap between A_{e1} and A_{e3}. These features indicate that SAE 5140 is much closer to eutectoid composition than SAE 2340

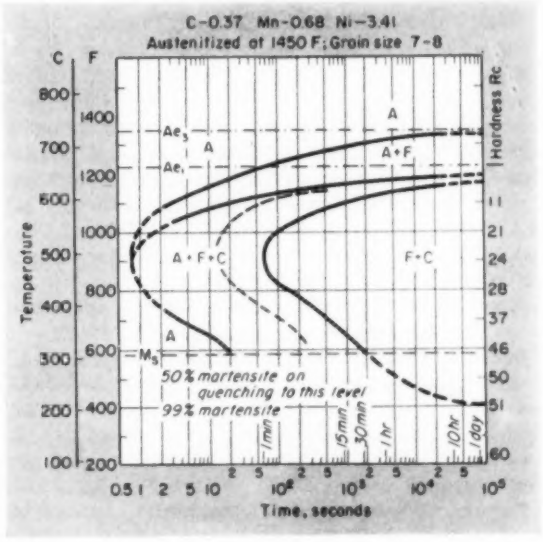


FIG. 2 . . SAE 2340, 3.5% NICKEL STEEL. Hypoeutectoid nature is clearly indicated by well-defined A + F field. Note sluggishness of transformation over SAE 1095

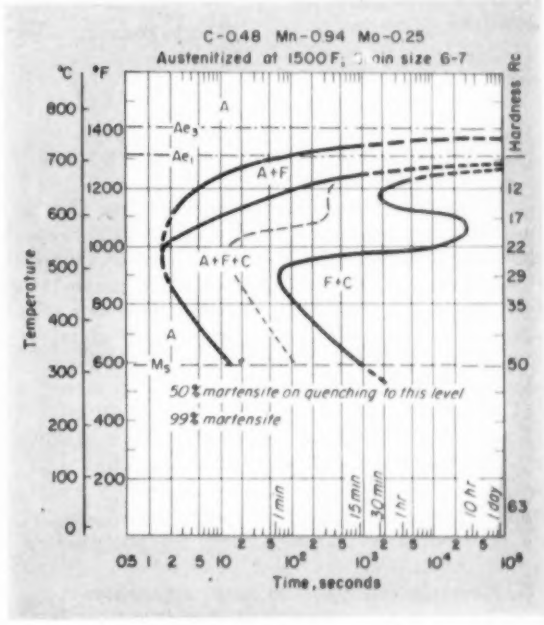


FIG. 4 . . SAE 4047, MOLYBDENUM STEEL.

3. Chromium and nickel, Ni, in combination, can decrease certain special attacks upon steel by chemical solutions.

This article will describe only the effect alloying elements have when added in a quantity per element of no more than 5%. In other words, high-alloy- and stainless-steels will not be described. Also this discussion, principally will deal with the effect alloying elements have on mechanical properties.

SPECIFIC EFFECT OF VARIOUS ELEMENTS

At room temperature the phases present in the steel can be ferrite and iron carbide, Fe_3C. When addition elements are added, either metal or non-

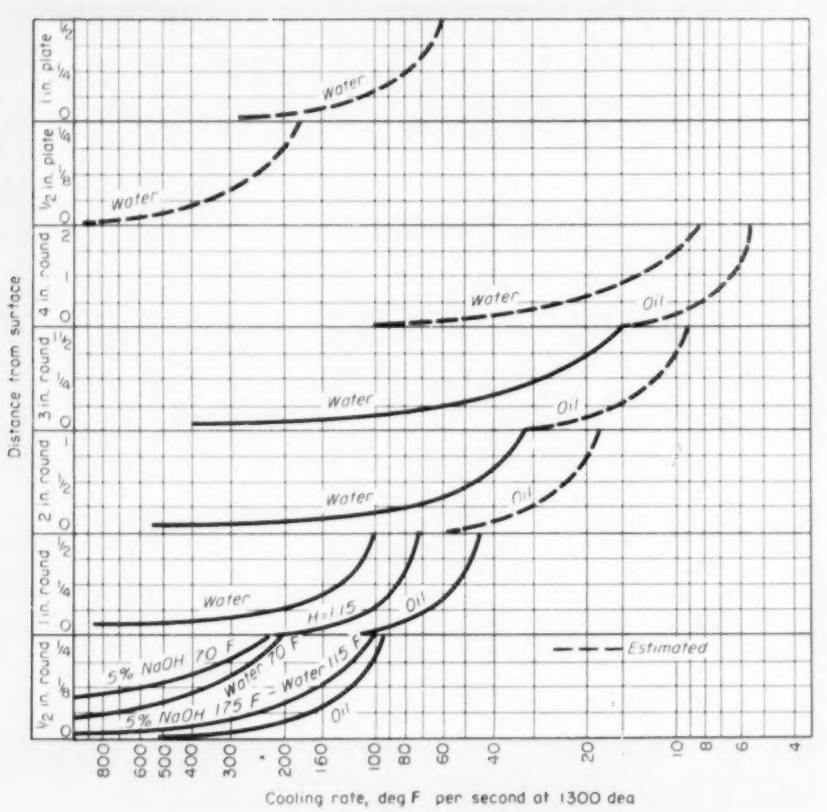


FIG. 5. . HARDNESS-COOLING RATE CURVE can be used to predict hardness "U" curves

metal, they can effect one, or more, of four things:

1. They can dissolve in the ferrite. This means that the bcc lattice accepts the new foreign atoms as *substitutes* for iron atoms. This phenomenon of one metal dissolving into another is known as a *solid solution* of one metal in, or with, another metal. In other words, the bcc lattice fundamentally remains the same, but instead of having only iron atoms in the cell, a foreign atom may displace one of the iron atoms and substitute for it. When elements dissolve in ferrite, a strengthening of this phase occurs without much loss in the ductility of the alloy. Among those elements which do this are: aluminum, Al; Ni; copper, Cu, up to 0.75%; silicon, Si; phosphorous, P; and cobalt, Co.

2. Elements can combine with the carbon in the steel to form new carbides, carbides other than Fe_3C. This can increase properties such as hardness, hardenability, wear resistance, and high temperature strength. Among the metals which form carbides when added to steel are: titanium, Ti; vanadium, V; columbium, Cb; W; Cr; manganese, Mn; and molybdenum, Mo.

3. Alloy elements can form non-metallics which are distributed in the steel. Several of these non-metallics can form around the grains in the steel as continuous or discontinuous films which retard the growth of the grains. This is, at times, very advantageous as finer grains give rise to greater strengths than do coarse or large grain sizes. Those elements which do not enter the steel in solution with ferrite or combined as carbides are: Al as Al_2O_3; Si as SiO_2; zirconium, Zr as ZrO_2; S; V; and P. Both Al and V are the best addition agents for inhibiting grain growth.

A simplified method of describing the influence of various alloying elements is shown in Table I.

Boron, B, has recently been under a great deal of investigation, but for one purpose only—to increase the hardenability of steel. Only a few thousandths of one per cent is ordinarily added to the steel to cause the alloy to harden to a greater depth when it is quenched.

To identify various grade classifications of steels the AISI and the SAE worked out a system of symbols which are relatively simple to understand and to use. Capital letter prefixes indicate the particular steelmaking process while numbers are used to classify the steel by tensile properties or chemical composition. The prefix letters are:

LETTER	DESIGNATION
A	Basic open-hearth alloy steel
D	Acid open-hearth steels
E	Electric furnace steels (both carbon and alloy)
NE	National Emergency steels

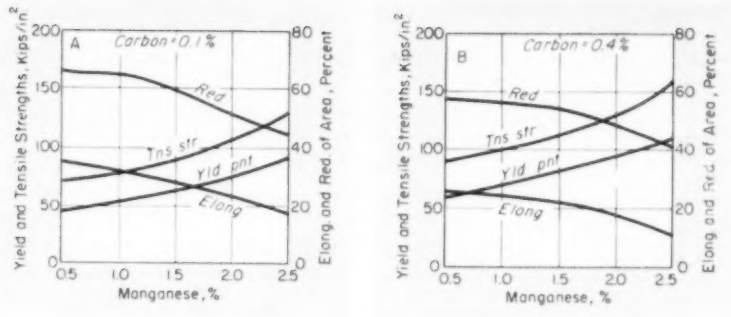


FIG. 7 . . YIELD AND TENSILE STRENGTHS of normalized manganese steels

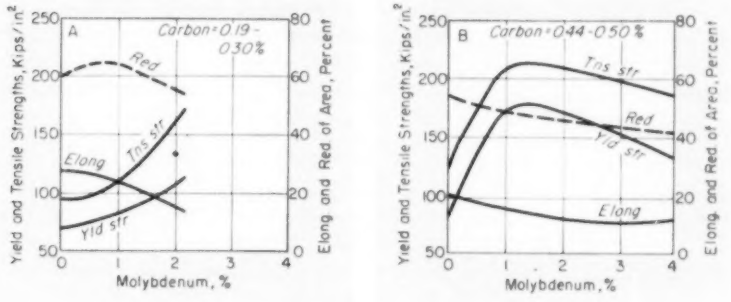


FIG. 8 . . TENSILE PROPERTIES of oil-quenched and tempered molybdenum steels — at 930-1020 F

alloy characteristics

1300 Series — The steels of this series are most often used in the through-hardening and semi-through-hardening grades. They have high strength in combination with fair ductility and excellent resistance to abrasion. They are used to a great extent in the manufacture of heavy forgings because they have good forgeability and respond well to heat treatment, particularly in large sections.

2300 Series — The 3½% nickel steels stand out in their dependability because of the simplicity in composition involving the addition of only one element which does not oxidize. They are deeper hardening than carbon steels. In addition, they reflect to a marked degree the toughening effects of nickel. They give greatly increased elastic properties and strength in comparison with carbon steels, without loss in ductility or resistance to impact. Lower temperature quenching with resultant decreases in scaling and distortion can be used. This series of steels also has excellent resistance to torsional and fatigue stresses.

2500 Series — Here are the steels almost always used in the carburizing grades. They are especially useful for machine parts requiring superior wear and fatigue resistance in the outside case, combined with high core strength and freedom from scaling and distortion. This is made possible by low-quenching temperatures.

3000 Series — Steels in this series are useful for parts in modern machinery for which the higher alloy steels are not required but for which commercial carbon steels are not adequate. This is true with respect to tensile properties or uniform response to heat-treatment. By use of the proper carburizing technique, the low-carbon grades develop a uniform file-hard surface with adequate case depth.

3100 Series — This series of steels shows all-around versatility up to 0.40% carbon. These steels can be water-quenched except in complicated shapes. They are well suited to parts with sections up to about 2 in., in which the strength required permits tempering at high temperatures, that is, between 800 and 1250 F. Under such conditions high impact and fatigue resistance are obtained which are coupled

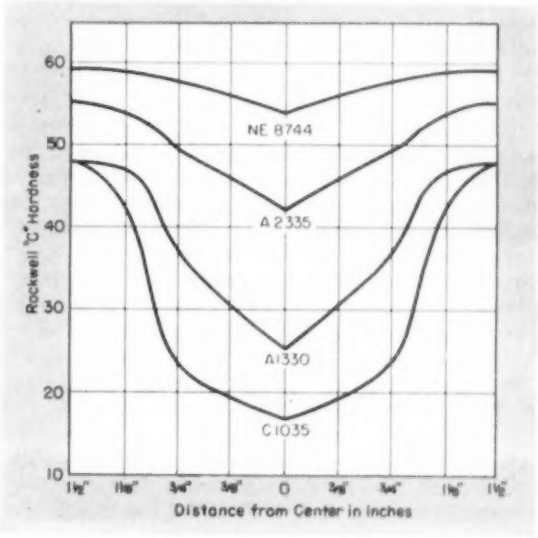


FIG. 6 . . HARDNESS CHARACTERISTICS of water-quenched steels

Table 1..TRENDS OF INFLUENCE—ALLOYING ELEMENTS

ELEMENT	AS DISSOLVED IN FERRITE STRENGTH	AS DISSOLVED IN GAMMA (AUSTENITE) HARDENABILITY	AS UNDISSOLVED CARBIDE IN AUSTENITE TOUGHNESS (FINE GRAIN)	DISPERSED CARBIDE IN TEMPERED MARTENSITE HI-TEMP STR	DISPERSED NON-METALLICS TOUGHNESS FINE GRAIN
ALUMINUM Al	MILD	MILD	NONE	NONE	VERY STRONG
CHROMIUM Cr	MODERATE	MODERATE	STRONG	MODERATE	SLIGHT
COBALT Co	STRONG	NONE	NONE	NONE	NONE
COLUMBIUM Co	?	?	VERY STRONG	STRONG	NONE
COPPER Cu	MILD	MILD	NONE	NONE	NONE
MAGNESIUM Mg	STRONG	MODERATE	MILD	MILD	NONE
MOLYBDENUM Mo	MODERATE	STRONG	STRONG	STRONG	NONE
NICKEL Ni	MILD	MILD	NONE	NONE	NONE
PHOSPHORUS P	STRONG	MILD	NONE	NONE	NONE
SILICON Si	MODERATE	MODERATE	NONE	NONE	MODERATE
TANTALUM Ta	MODERATE	STRONG	STRONG	STRONG	NONE
TITANIUM Ti	?	STRONG	STRONG	STRONG	NONE
TUNGSTEN W	MODERATE	VERY STRONG	VERY STRONG	LITTLE	MODERATE
VANADIUM V	NONE	VERY STRONG	VERY STRONG	VERY STRONG	MODERATE
ZIRCONIUM Zr	NONE	NONE	NONE	NONE	MODERATE

ALLOYING ELEMENTS and the physical properties produced by metallurgical characteristics are listed to show the effect produced by each element

with high elastic properties. In the annealed or softened conditions, they can be cold-pressed into intricate shapes and may be subsequently quenched and tempered. In the intermediate carbon range they exhibit a strong resistance to creep at temperatures up to about 1000 F and have found wide application in valves, flanges and fittings for high temperature service. Steels of this series when tempered after hardening to about 400 Brinell, exhibit excellent wear resistance in road building, excavating, and farm machinery parts, and in contact with nonmetallic abrasive materials.

3300 Series — The steels of this series are used widely in forgings and bars, in a variety of sizes, which must meet strict mechanical property requirements. These steels are more difficult to handle than the lower alloy nickel-chromium steels in manufacture, fabrication, and heat-treatment because, in part, they are air-hardening; hence they require reduced speeds and feeds in machining. Steels of this series are very reliable and have high strength and fatigue resistance per unit of weight.

4000 Series — These steels have extensive, relatively high quenching and softening temperature ranges. This makes production heat-treatment methods easier. Careful control of heat-treatment practice is required to meet exacting specifications as to tensile strength, yield strength, and ductility because these steels have a restricted temperature zone in which optimum physical properties are developed. However, relatively high tempering temperatures may be used without undesirable loss of hardness and strength. This results in high impact strength.

4100 Series—High hardenability is the outstanding property of this group of steels. On suitable heat-treatment either by quenching and tempering, or in

the case of 0.40 to 0.50% carbon, on softening and tempering, these steels develop properties which fit them for severe service characterized by fatigue, abrasion, impact, high temperature stresses, or combinations of such stresses. Chromium-molybdenum steels do not form adherant scale. Therefore, forging, rolling, and pickling are readily accomplished. The self-scaling characteristic of these steels reduces die wear, thereby adding substantially to the life of expensive forging equipment. Higher tempering temperatures are required to fully soften hardened chromium-molybdenum steels than are necessary for plain carbon steels of the same carbon contentfl Using tempering temperatures in the upper range causes these steels to develop excellent impact resistance. This series of steels is not subject to embrittlement either following the draw or after exposure for long periods of time at relatively high-temperatures. Chromium-molybdenum steels in the low and medium carbon range can be welded by either oxy-acetylene or electric processes.

4300 Series—Developed to meet service conditions in which other alloy steels have insufficient hardenability and, therefore, insufficient strength in the medium carbon range. In the heavier sections for which they were intended, these steels probably develop the best combination of ductility and strength of any of the constructional alloy steels. Because of their molybdenum content these steels do not soften readily at elevated temperatures. This group of steels is among the very few which offer a useful tensile strength up to 300,000 psi in one inch sections.

4600-4800 Series—Used primarily in the carburizing grades, these steels stand out for their uniformity of case and response to heat-treatment. They are relatively free from distortion during quenching and have excellent toughness at high hardness.

5000-5100 Series — These steels show a combination of high strength and fair ductility. They have good hardenability in an oil-quench, have low distortion characteristics, and do not decarburize at the surface. Because of the surface hardness which these steels attain they exhibit excellent wear resistance characteristics.

52100 Series—Used primarily for balls, ball-races, rollers, and roller bearings, these steels evidence high hardness and excellent wear resistance. They can be heat-treated to a surface hardness of Rc 63-65 and at that hardness have high fatigue values. Because these steels are susceptible to quench cracks they must be handled very carefully.

6100 Series — The steels in this group are characterized by fine grain structure, high strength, and excellent ductility. The lower carbon grades, when carburized, exhibit a hard, tough, wear-resistant case and a core structure which does not flake, powder, or flow under pressure. They are readily welded and have good machinability. They also exhibit very low distortion characteristics when quenched either in oil or water.

8000 Series — High impact strength and resistance to fatigue characterize these steels. They are also easy to forge, easy to machine, have good weldability,

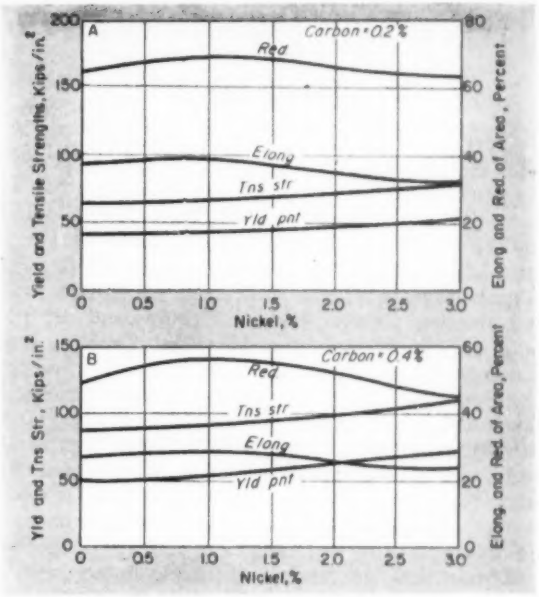


FIG. 9 . . **TENSILE PROPERTIES** of normalized nickel steels

have stable mechanical properties at high temperatures, respond well to heat-treatment, develop good depth of hardness, and have good ductility.

8600, 8700, 9400, 9500 Series — The characteristics of these four groups of alloy steels overlap with those of the 4300 series, except that the latter series can be used for larger sections. The main advantages of these steels are: good fatigue-tensile properties, toughness at high hardness, good depth hardness, good response to heat-treatment, stability of structure at elevated temperatures, good machinability, and relative freedom from distortion in quenching.

9200 Series — The steels in this group were developed as spring steels for both automotive and railroad service. However, their high strength, excellent toughness, and resistance to shock also makes them useful in the manufacture of hand-tools.

To recapitulate and extend the previous discussion:

1. The principal two components which make up a steel, whether carbon or alloy, are ferrite and carbide. The final physical properties of a steel are controlled by the microstructure, the structure seen under a microscope. This structure shows the quantity of each component present and its dispersion or distribution.

2. The influence of alloying or addition elements in bringing about their most useful functions is threefold:

   a. They change the distribution of the carbides in the ferrite matrix.
   b. They change the properties of the ferrite by going into solution in it.
   c. They change the quality or type of carbide, or form a different carbide, as compared with iron carbide or cementite.

isothermal transformation diagrams

An understanding of the effect of carbon, as well as the alloying elements, on the transformation of iron and steel has been very skillfully brought about by the use of a special diagram. The previous report, on plain carbon steel, described the Equilibrium or Phase Diagram for iron and carbon which gave only information for alloys at equilibrium and did not give aid in understanding the effect of cooling rate upon the alloy. To aid the metallurgist in comprehending steel alloys, the Isothermal Transformation Diagrams were devised. Perhaps they are better known as "S" curves or "T T T" (Time, Temperature, and Transformation) curves. What is done to construct such a curve is to select a particular steel, cut a small specimen from it, heat it at a constant temperature (isothermal treatment) for a specific length of time, quench it, and then examine its microstructure and determine its hardness. This is repeated for various temperatures with different pieces of the steel held at these temperatures for increasing lengths of time. The microscopic examination is used to determine the percentage of transformation that has occurred for the length of time the specimen was held at temperature. When all of the data are collected, a combined plot is made of Temperature and Hardness versus the log of Time.

Fig. 1 is a typical S curve of an S A E 1095 carbon steel which is almost of the eutectoid carbon steel composition, 0.89% C instead of 0.80% C. The symbol A in the diagram represents untransformed austenite, F represents ferrite and C, carbide. The symbol M. means the start of martensitic transformation while Ae represents the critical temperature for equilibrium. That is, the temperature where gamma or austenite starts to transform to ferrite and carbide. This is also the minimum temperature at which any hardening effect is observed. Fundamentally, this curve or map shows conveniently how long it takes for complete transformation. If 1200 F is selected as the isothermal transformation temperature, notice that for five seconds there is no effect on the austenite. However, at five seconds the first heavy curved line is intersected and transformation starts with both ferrite and carbide now existing together with the austenite. After about 170 sec (intersection with the dotted line), the austenite is half transformed and after approximately 300 sec, intersection with the final dark line is made and the austenite is completely transformed to ferrite and carbide. Additional time at 1200 F will cause no further transformation. The hardness of this final ferrite-carbide mixture as it exists at room temperature is obtained at the right ordinate of the S curve and is Rc 33. Thus, the first heavy line represents the beginning of transformation, the dotted line represents the transformation when it is half completed, and the last heavy line represents the completion of

Table 2.. NUMERICAL CLASSIFICATION—ALLOY STEEL

S A E NUMBER	CLASSES AND TYPES (as represented by first two numbers in series.)
10 xx	Plain Carbon steels
11 xx	High S free-machining steels
13 xx	Mn = 1.60 to 1.90%
23 xx	Ni = 5.00%
30 xx	Ni = 0.70%; Cr = 0.70%
31 xx	Ni = 1.25%; Cr = 0.60%
32 xx	Ni = 1.75%; Cr = 1.00%
33 xx	Ni = 3.50%; Cr = 1.50%
40 xx	Mo
41 xx	Cr — Mo
43 xx	Ni — Cr — Mo
46 xx	Ni = 1.65%; Mo = 0.25%
48 xx	Ni = 3.25%; Mo = 0.25%
50 xx	Low Cr
51 xx	Medium Cr
52 xx	Cr; high carbon, C
61 xx	Cr; V
86 xx	Ni = 0.55%; Cr = 0.50%; Mo = 0.20%
87 xx	Ni = 0.55%; Cr = 0.50%; Mo = 0.25%
92 xx	Mn = 0.80%; Si = 2.00%
94 xx	Mn = 0.95 to 1.15%; Si = 0.50%; Ni = 0.45%; Cr = 0.40%; Mo = 0.12%
95 xx	Mn = 1.35%; Si = 0.50%; Ni = 0.55%; Cr = 0.50%; Mo = 0.20%

ALLOY STEELS are designated according to specified chemical composition ranges in a four-numeral series. The last two numbers of this series indicate the approximate middle of the carbon range. For example, in 1030, 30 represents a range of 0.28 to 0.33%. The significance of the first two numbers is described in the table

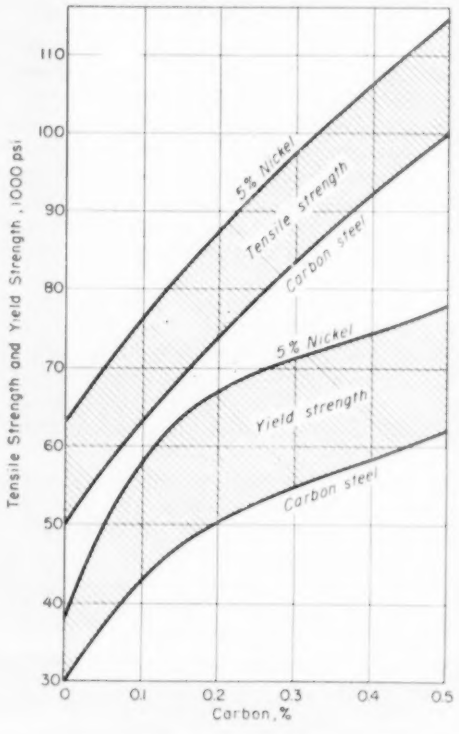


FIG. 10 . . **STRENGTH** of normalized steel as affected by nickel

transformation. The hardness plot on the right is as measured at room temperature for the completely transformed alloy. The bent portion of the curve nearest the temperature ordinate is termed the "knee" or "nose" of the S-curve and is, perhaps, one of the most important parts of the curve. The reason is simple. If the alloy in question is cooled rapidly enough so that its rate of cool passes the knee of the curve without intersecting it, no transformation

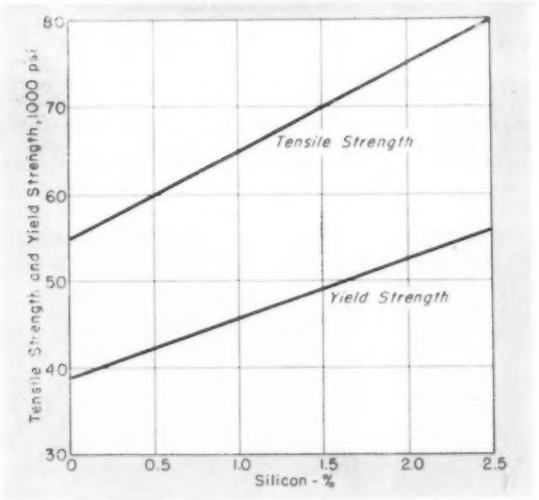


FIG. 11 . . SILICON causes an increase in both tensile and yield

to ferrite and carbide will occur. At about 420 F, the M_s line, the austenite will start to transform to martensite, will be half martensite at about 320 F, and 99% martensite at approximately 180 F. (For all practical purposes, the phase martensite forms only during cooling not while being held at a particular temperature). The hardness will be, when cooled to room temperature, Rc 66. If the rate of cool (the slope of a line drawn from the austenite temperature in question to the time it takes to cool the alloy) were not rapid enough to bypass the knee of the curve, some ferrite and carbide would be present and would decrease the overall hardness of the alloy. A basic reason for alloying carbon steel is to "push" the knee of the S curve to the right. This means that a slower cool could still miss the knee and give one a fully martensitic structure. This is of very practical value because it is now possible to cool thicker sections with their consequent slower rates of cool and have them fully martensitic. This means increased depth of hardness or improved hardenability. A number of typical S curves for different alloys are shown, Fig 2 to 4, to indicate the effect of the various alloys on the curves.

Of course it should be realized that S curves have great diversity and are of excellent use for a number of heat-treatments other than directly quenching to martensite. For instance, the two processes of austempering and martempering are more readily accomplished and understood when using these diagrams. In austempering, the alloy is cooled past the knee to a temperature below it and above the M_s line. Here it is held until it is transformed to bainite and then it is cooled. In martempering, the alloy is cooled past the knee, just past or slightly above the M_s temperature. The alloy sample is then held at this temperature until the temperature throughout the piece is substantially uniform. It is then allowed to cool in air through the temperature range of martensite formation. The alloy in this condition is free of macrostresses resulting from temperature variations

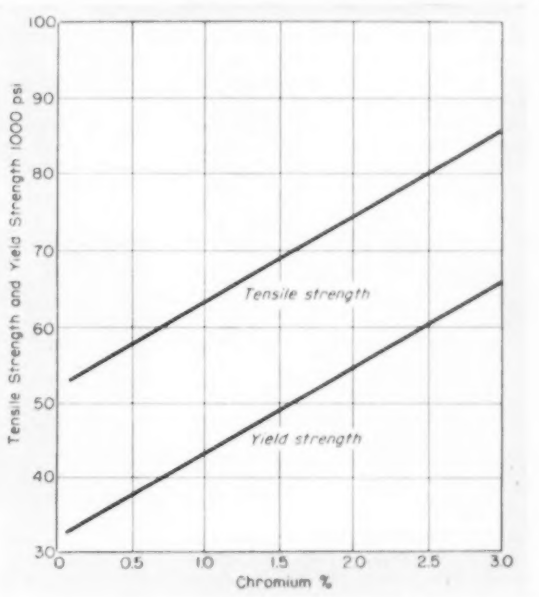


FIG. 12 . . EFFECT OF CHROMIUM

usually formed during normal quenching. The high level of microstresses which normally accompany this transformation, however, continue present and the alloy still requires the usual subsequent martensite tempering operation.

Before concluding this section, it should be stressed that the knee of the S curve can be pushed to the right not only by alloy addition but also by increasing the grain size of the alloy and by raising the austenitizing temperature, (the temperature above which partial or complete transformation to austenite occurs).

hardenability

To adequately describe the many steels developed it has become necessary to devise another style of test. This is the standard *"end-quench hardenability test"* which is simple and gives quick and easily obtained information regarding the microstructure of the steel in various sizes when quenched in oil or water. The ordinary mechanical properties of steel are known to be dependent on the hardness of the steel. This in turn is dependent on the microstructure of the alloy and, therefore, is also dependent upon the rate at which the steel is cooled. The above test,

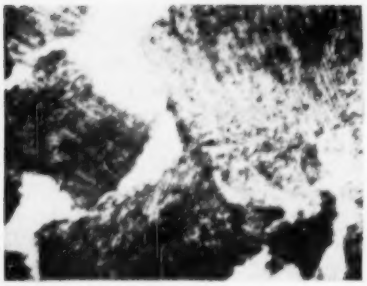


FIG. 13 . . SMALL SCREWS for an aircraft engine are made from this alloy (1.0% Ni, 0.5% Cr, 0.5% C). It is readily machined; provides good surface finish on threads and shank. Coarse pearlite is seen surrounded by ferrite, the result of a slow cool on a coarse-grained austenite structure. 1000 X magnification and Picral etch

FIG. 14 . . SAME ALLOY AS IN FIG. 13 but difficult to machine. More than 50% rejections. Hardness is identical, R_c 90. Instead of continuous ferrite, structure is spheroidal. Can be corrected by heating to 1700 F for ½ hr to dissolve carbides in austenite; thus change spheroidal structure to pearlitic—1000 X

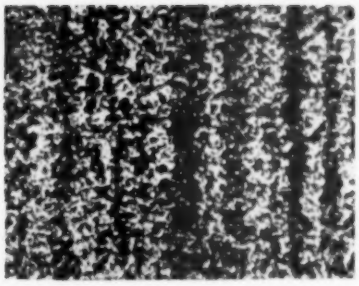


FIG. 15 . . STRUCTURAL STEEL (1.25% Mn and 0.10% V) for railway generator shaft. Vanadium has made alloy very fine grain which is desirable for this application. Structure shows ferrite, light areas as strata (bands caused by rolling and slow cooling), and pearlite. 100 X magnification with Nital etch

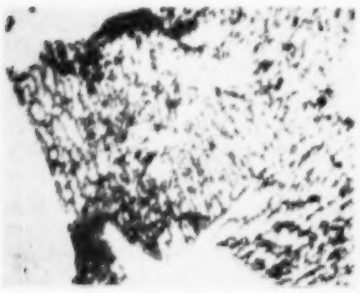


FIG. 16 . . SAE 2340 (0.37% C and 3.4% Ni), slowly cooled (furnace cool) from 1740F. Ferrite (light areas) and pearlite (dark areas) are clearly seen. Cementite in the pearlite is starting to become spheroidal. Hardness of R_c 72, Brinell 202, is appreciably higher than that of an equivalent plain carbon steel

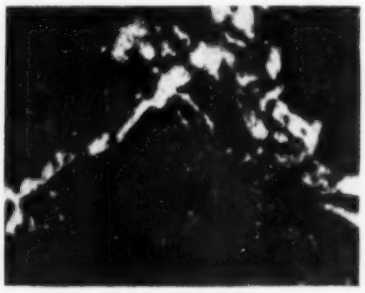


FIG. 17 . . SAE 2340 BUT AIR-COOLED (rapid) from 1740 F. Unresolvable pearlite (dark areas) is seen, plus some traces of ferrite. Section is ½-in. thick. Hardness of R_c 85, Brinell 247, is also considerably higher than that of plain carbon steel

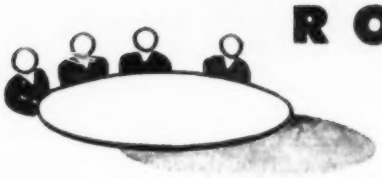
FIG. 18 . . T 1335 ALLOY (0.35% C and 1.85% Mn) as furnace-cooled from 1740 F. Annealed structure contains finer pearlite than plain carbon steel, plus less ferrite. This results from the decrease in eutectoid carbon, also, perhaps, slight undercooling. Hardness is R_c 75, Brinell 210 similar to annealed 2340. Mag = 1000 X

also known as the *Jominy Test*, determines the hardenability of the steel.

The test consists of water-quenching one end of a 1-in. dia X 4-in. long cylinder of the steel to be tested. The cylinder is heated for 20 minutes, then placed in a fixture and one end of it is quenched for 10 minutes, using a ½-in. dia jet of 75 F + 5 F water. Two flats 180° apart are ground along the length of the bar and Rockwell readings are taken on the center line of the flats at 1/16 in. intervals.

Because only one end of the bar is subjected to the action of the quenching water, various rates of cooling exist along the length of the bar as the heat flows from the hotter to the colder areas. Thus, the effect of this test is a depth of hardening test and its values can be and have been correlated with the cooling rates and hardness values of various size rounds when oil- or water-quenched. The curves obtained for A3140 and A1040 steels where hardness is plotted versus distance from the quenched end, bottom scale, and cooling rate, top scale. ¼-in. away from the qunched end, the values are Rc 58 and 56.5 respectively. This would mean that ½-in.-dia bars made of these steels would harden throughout (completely transform to martensite). One in. away from the quenched end, the values are Rc 58 respectively. This now means that a 2 in. dia 3140 bar could be quenched so that it would harden to a peripheral depth of ⅞ in. while a 2 in. dia 1040 bar would only harden to a depth of ⅛ in.

It would be interesting to be able to predetermine the hardness across the diameter of a bar of a steel for which we have the Jominy test curve. This can be done by using the Jominy curve and Fig. 5. This figure is a plot of distance from the surface of various diameters rods versus the cooling rate when the bars are quenched in various media. Thus, for a 3 in. dia NE 8744 bar, water quenched, the cooling rate at the surface is 400 F/sec and at the center 15 F/sec. For the NE 8744 curve, cooling rate of 400 F/sec evidences Rc 59 and a rate of 15 F/sec, Rc 54. Thus, by obtaining cooling rates at various distances in from the surface, hardness can be predicted at these distances and a "U" curve plotted for the different alloys. If a specification read that a 3 in. bar were required for a job with a minimum hardness of Rc 30 it is seen from Fig. 6 that only the NE 8744 and 2335 steels would be acceptable.



ROUND TABLE

'Portioning Out the Pie

"You're not your usual cheerful self today, Al. What's the trouble?"

"Money trouble, Ed. I've got a problem I can't solve—in fact, I doubt if it *can* be solved."

"Go ahead, shoot!"

"Well, Ed, it started with Bill Hanson asking for more dough. He claims he's worth more than the other guys in the shop because I always give him the trainees to break in; and, of course, he does regular work, too."

"That's not such a tough one, Al. Just tell him off. He's not worth more than anyone else, just because his job is slightly different."

"Yeah; then I lose him. The trouble is, he *is* worth more; at least his work is more difficult because he's always dealing with new men. Actually I'd like to give him a nickel more an hour, but can you imagine the bickering I'd start up if I put a raise through for him?"

"Sure, all the other guys would be on your neck for the same raise. You can't let one man get ahead of the others—even if you think he's worth it. If you do, right away you have a real labor problem on your hands; and you get the boss down on you for causing budget trouble, too."

"I know, Ed. One of the things I was thinking about as a solution is job evaluation. Do you think that would work?"

"Not a chance, Al. That business is for the birds. Too much red tape; and you lose control over your department because too many other people get their fingers in the pie. I've seen "job evaluation" kick up trouble too many times to trust *that* idea."

"But you're supposed to be rating the job, not the man. It would give me a chance to slip in some extra dough for the guy who trains new men—and that would make Hanson happy. I'd sure hate to lose that guy. He's good."

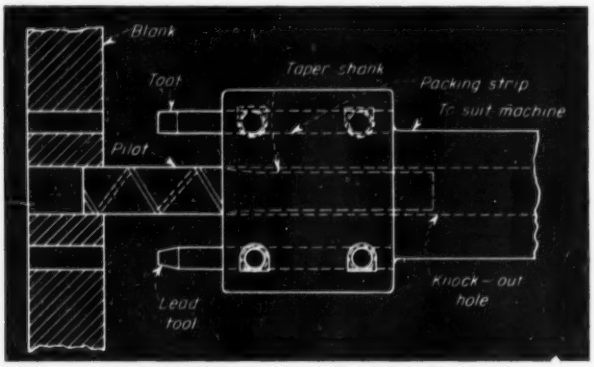
"I think you're stuck, Al. You can't convince the men you're rating the jobs, not them, no matter how much you talk to them or what literature you get out on the subject. It's a quick way to kick up headaches, as far as I can see."

"Maybe so, Ed; but I'd sure like to give it a whirl. I think the idea might save us a lot of our usual kickbacks and complaining, once the men got used to the idea."

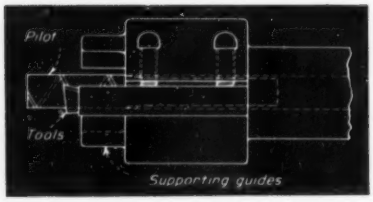
"I think your best bet is to let Hanson go, if he insists, and try to replace him. You can't take chances with your whole force just to make one man happy."

***IS HANSON WORTH MORE** money than his mates? How can he be paid more? Is job evaluation a worthwhile idea, or is it unworkable in many shops? Your opinions may help and interest others in similar situations. Discussions of earlier topics appear on later pages.*

Practical Ideas



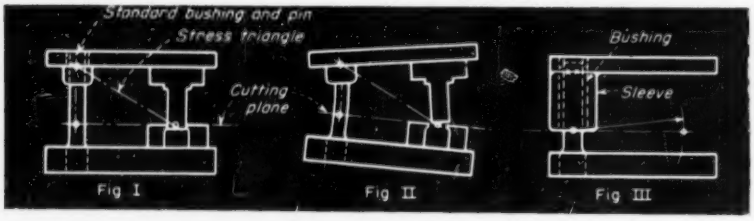
Trepanning Tool Saves Material



By using a specially designed trepanning tool instead of a drill, the material removed by making a hole in a gear blank, disk, or cam may be salvaged, provided the saving is warrantable. The special feature of this tool is that the blanks produced are concentric, squared, and properly sized without further machining.

The trepanning unit, placed in the chuck of a boring mill, is constructed around a properly-sized pilot which is inserted in the center hole of the work to assure concentricity of the periphery. This pilot may be removed and replaced to conform with requirements by using a knock-out hole in the stem.

The pilot is flanked by two cutting tools. One, blunt pointed, is set slightly ahead of the other, thus insuring that the second cleans up the break-through fin thus achieving a clean cut blank. As the cut progresses, two integral supporting guides enter the trepanned groove and steady the cutting tools. Packing strips or shims placed on the inside of the cutting tools will alter the width of the trepanned groove. *Frank W Coulson, Barnstaple, Devon, England*

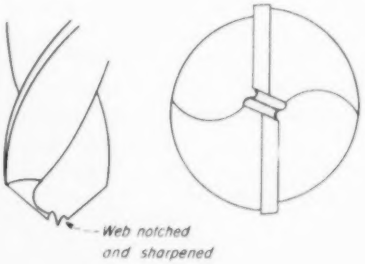


Adding Sleeve Maintains Punch Alignment

Maintaining punch alignment is a great problem in progressive or multiple station dies. The average punch-press in which these tools are used is apt to have deficiencies in the gib clearance resulting from normal wear, hence out of parallel conditions of the ram and bed develop from handling and repeated setups. These errors are magnified by the tonnage required to perform the function of the die itself. A die with insufficient stability to overcome these forces will shear itself, chip cutting edges, break punches, produce irregular break lines, and show large burrs at the cutting areas on the work produced.

Though pin deflection and improper fitting of bushing and pin, or bushing and pin contact areas, contribute to the problem, there is a stress triangulation factor which is the greatest cause. It is a very simple thing to determine the potential error of alignment at a die's cutting edge when fixed values for this triangle are applied.

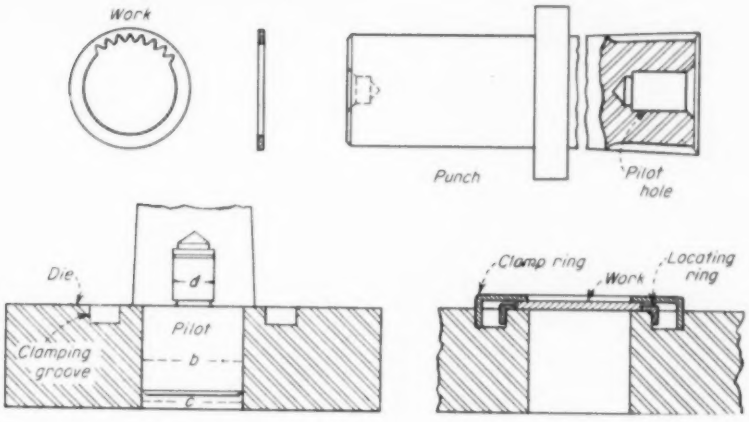
Illustrated is a simple sleeve and bushing which, welded onto the platform holding the punch, replaces the standard bushing and pin and adds stability; thus lowers the stress triangle. *A Peterson, Grand Rapids, Michigan*



Notched Drill-point Speeds Production

By using a drill grinder with a dressed wheel to fashion a notch across the web on each side of a regular drill point, drilling will be greatly accelerated. Furthermore, the necessity for using a small drill as a guide is eliminated and drill-wandering is minimized.

This type of point gives the web a cutting action similar to that of a two-fluted endmill and the larger the drill the more obvious becomes the advantage. *Louis Michelotti, New Rochelle, N Y*



Punch and Die Setup Utilizes Alignment Pilot

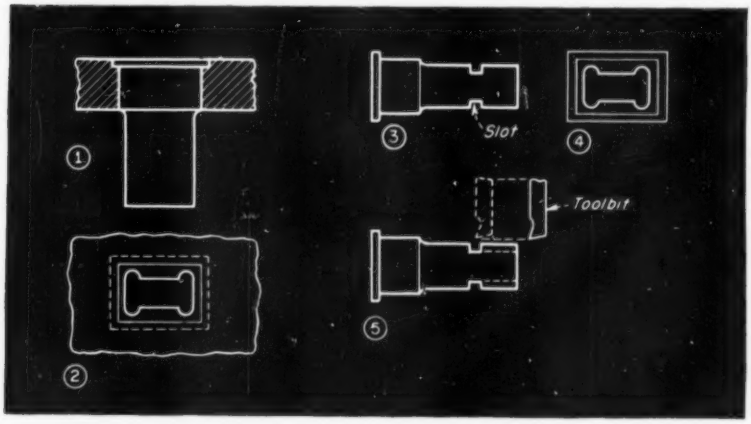
At times, limited quantities of work do not warrant constructing a complicated dieset. Here is the method we used, utilizing an alignment pilot and an arborpress, to make the small internal ratchet gear shown in the above sketch.

The punch was made to the required shape and hardness; then its face was ground. The die blank, which was circular to avoid warping after heat treatment, was turned to provide a center hole and a clamping groove. An alignment pilot was fitted to the center hole of the die and within the punch. The three units, punch, pilot, and die blank, were placed under an arborpress and the pattern of the tooth form in the punch was impressed on the soft die blank.

After removing the alignment pilot, the teeth in the die blank were slotted with a slotting tool and carefully finished with a file to insure proper functioning.

The die blank was next heat-treated, checked for possible distortion of the tooth form, then face ground. This completed, a locating-ring was permanently and tightly installed into the groove of the die blank to receive the work which, in turn, was held by a clamping ring so constructed that it could easily be removed for extracting the finished part.

Future work was found to have the OD accurately aligned with the teeth. *C Y Lee, Taiwan, China*

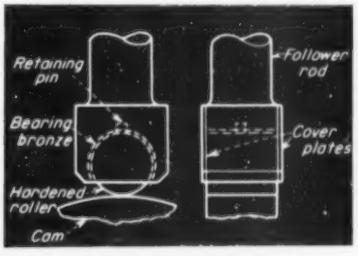


Slots Enable Standard Shaper to Make Special Punches

It is difficult to make irregularly-shaped contour blanking punches unless special machines for this purpose are at hand. However, a standard shaper may be used if the following method is employed.

Two transverse slots are made in the middle of the punch, on both of the longest sides. These slots permit the shaper tool to advance into them as the desired contour is cut.

When one side is completed, the shaper vise is given a 90° turn and the remaining surface is shaped. Caution should be used in keeping the cuts small and the feed fine. *F Strasser, Santiago de Chile*

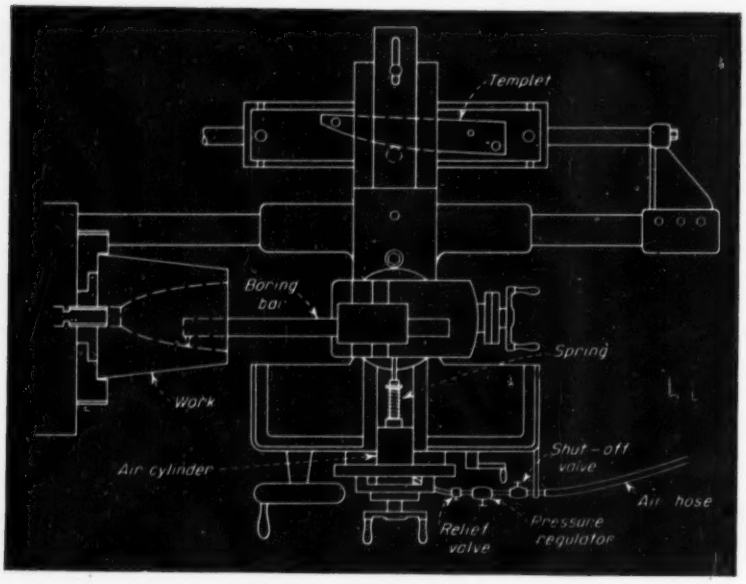


Cam Roller Replacement Increases Bearing Area

We had completed several machines of a new model only to discover that the cam follower bearings were wearing excessively. To provide space for a larger yoke and pin would have required major design changes in the machine.

The usual cam roller mountings were replaced by a piece of square stock, one end of which was bored to take a bronze bearing which in turn was bored to accommodate the cam roller. The end of the follower rod was milled off and plates secured to each side to keep the roller in place. A short retaining pin kept the bearing from shifting.

This replacement retarded wear. *Henry Gifford, Bronx, NY*



Contour Attachment has Air Pressure Crossfeed

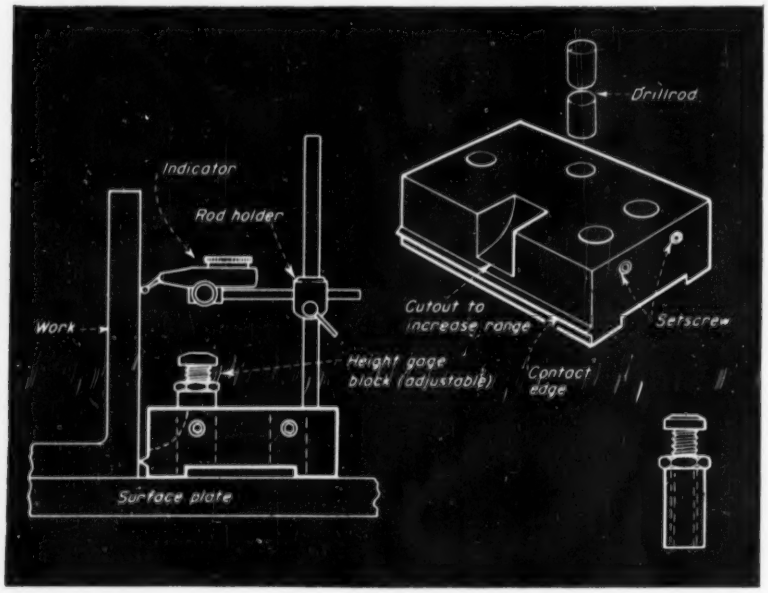
Here is a contour attachment that with minor changes in design can be adapted to almost any engine lathe. We constructed it originally to machine a number of forgings but have found it very satisfactory for several other jobs in the shop.

Any interested tool designer will especially note that the attachment is equipped with an air pressure unit which insures constant contact of the cam roll against the contour. With this arrangement, the pressure is easily withdrawn when desired and the operator's hands are free.

Construction is as follows: The taper bar and guide shoe of the lathe are replaced with a piece of crs plate shaped, slotted, and drilled to requirements, and with a stud having a roller-bearing cam follower on the end. The templet necessary to form the desired curve is then screwed and doweled to the plate. A bracket is mounted on the front of the carriage with an air cylinder clamped in it. An adjustable stud is placed in the end of the piston rod so that it will contact the cross-slide casting in the proper position. The cylinder has a 3-in. bore and is connected to a flexible airline through a diaphragm pressure regulator and a valve. A compression spring minimizes cutting tool chatter.

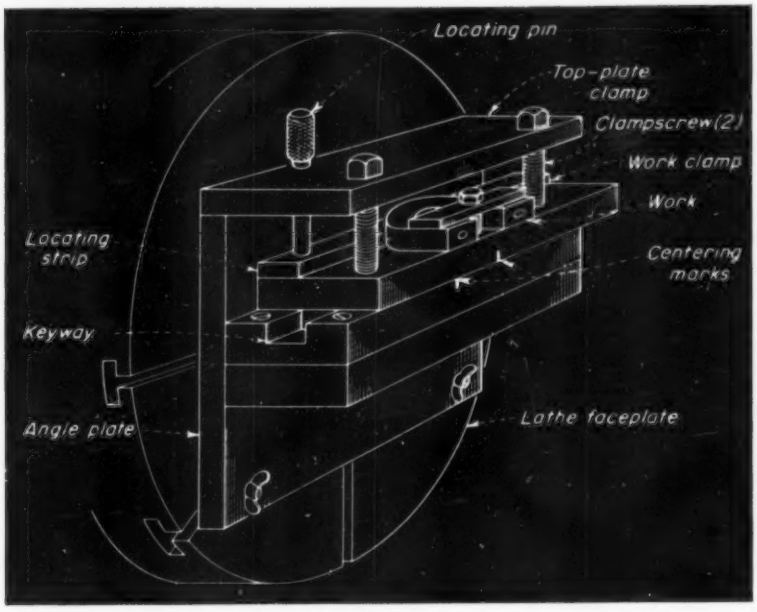
In designing the templet, it must be remembered that it will be quite different from the contour of the finished product as it is necessary to compensate for the fact that the templet follower is a roller while the cutting is done with a single point tool. *Ralph C Conklin, Kingston, N Y*

Multi-Purpose Gage Support



Illustrated is a gage block, 3 x 4 x 1 in., which has proven to be highly practical. Its most unique feature is a V shape, carefully ground, which has the contact edge on one of the long sides. This design eliminates the danger of distortion by dust or dirt between the base and square when in use. An extra hole enables the dial gage to be held in two positions, and the base is supplied with two holes in which adjustable height blocks can be inserted. *A Egle, Milwaukee, Wis*

As a roller-stop for drilling, a hardened and ground bushing having a hole 0.005 in. larger than the drill to be used is excellent. The bushing will turn on the drill between the drill chuck and the stock when the bushing bottoms. *G W Allen, Rochester, NY*



Dual Functioning Aligning Fixture

A fixture which permitted both facing and drilling two off-center holes without disturbing the original setup saved us much time in producing bronze half-castings which ultimately were to be bolted together dead flat.

The fixture, attached to the faceplate of a lathe, consisted of an angle and clamp-plate. Between these were a base and top plate, the latter fitted with a key and a locating strip containing two properly spaced holes.

The work was clamped to the top plate at center with a pair of square-head screws; then faced.

To drill the holes the top plate was loosened and slid either back or forward and the locating pin inserted in the appropriate hole. The top plate was then reclamped and one hole bored by a tool chucked in the tailstock. Again the top plate was released, the locating pin removed, and the second hole aligned for drilling. *N Smith Bradford, Yorkshire, England*

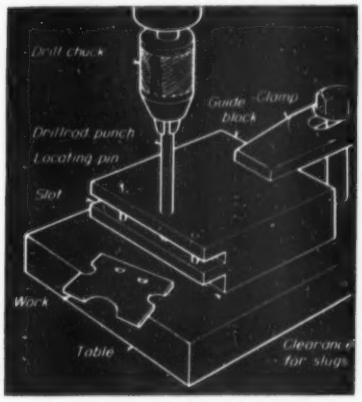
Drillpress Used as Punch

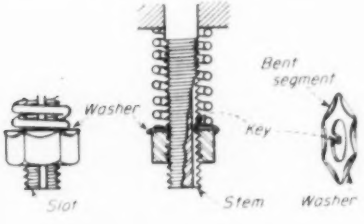
By constructing a guide-block of steel, we were able to use a drillpress to produce two clearance holes in some fiber strain-pieces.

The guide consisted of a punching hole, a guide slot, the depth of which was suited to the job, and two pins properly spaced. This was clamped to the drillpress table.

The work was inserted resting against the back of the slot, and against one of the pins; then the first hole was punched by a rod with which we had replaced the ordinary drill. Next the work was slid over against the other pin and the second hole punched.

We have found that variations of this guide, which enables a drillpress to function as a punch, are an inexpensive solution to many special problems, the amount of work required not warranting the construction of special diesets. *C H Willey, Penacook, N H*





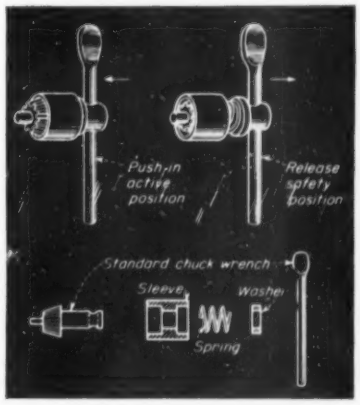
Lockwasher From Plain Washer

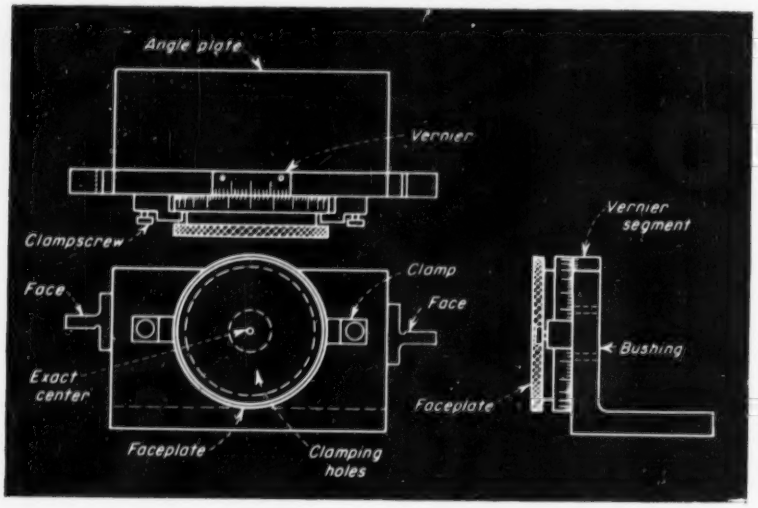
Here is a very effective lockwasher, made from a round washer, and equipped with a lug that fits into a groove made in the bolt. The six segments extending from under the hex nut are bent up to form a nest for the nut.

The washer retains the nut in position, even under severest vibration, yet it readily can be turned for adjustment. *Haim Murro, Bayonne, N J*

Safety Guard for Drill-Chuck Wrench

It is a careful operator indeed who has never raised a blood blister or suffered worse injuries while using a chuck wrench. Here is a simple safety device for these wrenches, consisting of a sleeve, a spring, and a washer which will eliminate the hazards. The handle is pressed out of the key, then the sleeve spring, and washer are placed over the key shaft. *Frederick Barker, Ilion, N Y*





Vernier Faceplate Determines Precision Angles

The instrument shown consists of an angle plate in which is inserted a graduated and knurled faceplate equipped with a lapped stem. Two height-gage blocks, one on each side, serve to quickly determine the exact fixture center. The top of the instrument is supplied with a segment vernier and the two clamps are used to fix the position, once the proper reading has been determined. The faceplate has an exact center hole. *L R Elliott, Oakland, Calif*

Split Tubing Protects Thread on C-Clamp

One of the most annoying problems encountered when C-clamps are used to hold work for welding or soldering is metal splashing on the clamp-screw. Blobs o metal will keep the screw from turning and thus slow production. A piece of tubing, approximately the length of the clamp-screw, is slotted to remove about one-quarter of its circumference. The slotted tube is slipped over the screw so it is guided by the enlarged portion of the frame carrying the internal thread. Then the lower end of the tubing is welded to the rim of the clamping pad or cup.

When the screw is turned, the guard moves longitudinally with it but offers no interference to the regular operation of the clamp. This simple addition to the clamp will be found helpful in many setups, as it prevents chips and dirt from jamming the threads. *Haim Murro, Bayonne, NJ*

Reaming Copper-Base Alloys

Hand- and machine-reaming copper-base alloys often is difficult. The reamer tends to pull into the work, thus scoring it and the rapid tooth wear causes holes to turn out undersize.

Best results can be obtained by using an endmill on these metals. However, the endmill should be ground 0.003 in. over the maximum hole size. Additional tool life can be gained by burnishing the outside dia of the endmill teeth at 45 just before they become dull.

On inside diameters, where close tolerances are desired, and the wall thickness is small in relation to the hole to be reamed, there should be a wall of at least 1/64 in. before reaming to size. *Gordon Smith, Longmeadow, Mass*

Winner No. 181
of
$25 *In addition to regular payment*
in
June 22, 1953

A. VETSCH
Steffisburg Station
Switzerland

Boring Tool Uses Taper Shaft

for the best PRACTICAL IDEA

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT — $25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

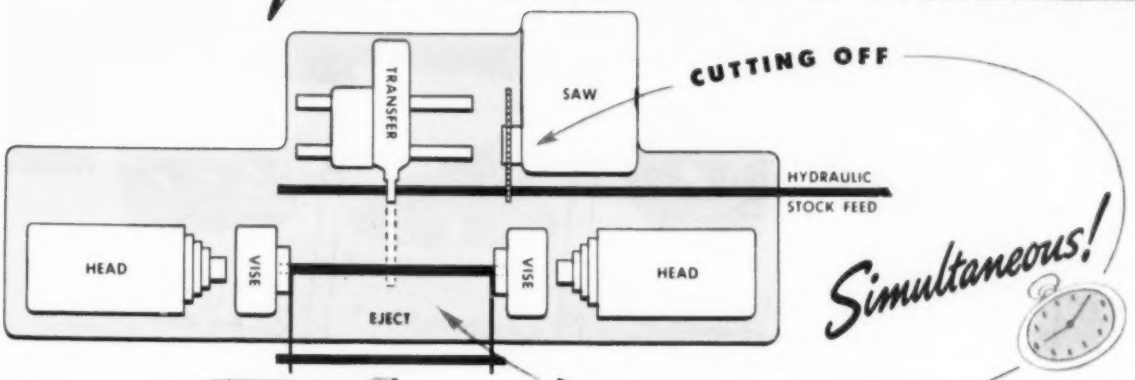
REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

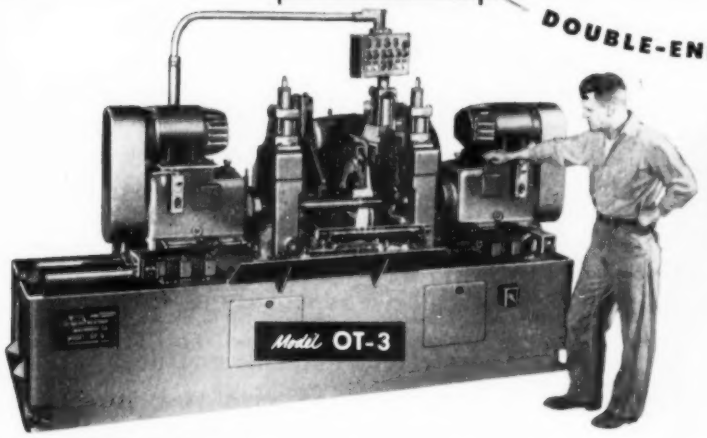
WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 36, N. Y.

Variety..

CUT OFF while you DOUBLE-END MACHINE on MOTCH & MERRYWEATHER AUTOMATIC TRANSFER MACHINES!





BORE • FACE • CHAMFER • CENTER
DRILL • TURN • REAM • GROOVE
and other operations, singly or "unitized"

MP/SF
Most Production per Square Foot

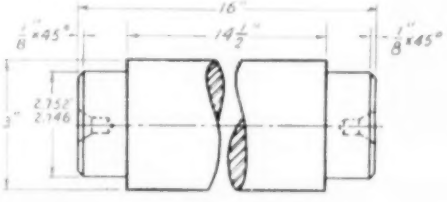
PRO RE DUCE PROFIT COSTS... Three or four machines in one. Cut off to accurate length and double-end machine simultaneously. Cut-off time is virtually "free". *Change-over quick from job to job!* Ideal for short or production runs. Cycle fully automatic. *Remember:* it's the cost per piece that counts.

Case Study No. 182

Operation: Cut off, box mill, turn and center drill both ends.

Material: SAE 1020.

Production: 110 pieces per hr.



SPECIFICATIONS

ITEM	Model OT-3	Model OT-4½	Model 2T-6
Rated diameter stock	½" to 3"	¾" to 4½"	1" to 6"
*Standard work length	8" to 40"	8" to 40"	8" to 40"
Weight (approximate)	11,500 lbs.	15,000 lbs.	26,000 lbs.

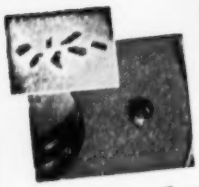
*Work length can be increased by special arrangement.
NOTE: Supplied for ferrous or non-ferrous applications.

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —
CLEVELAND 13, OHIO
Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

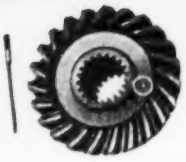
PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

METAL DISINTEGRATION

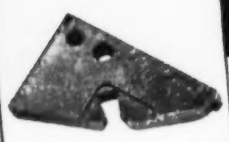
and what it can do for you . . .



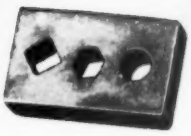
Remove Broken Taps fast without distortion



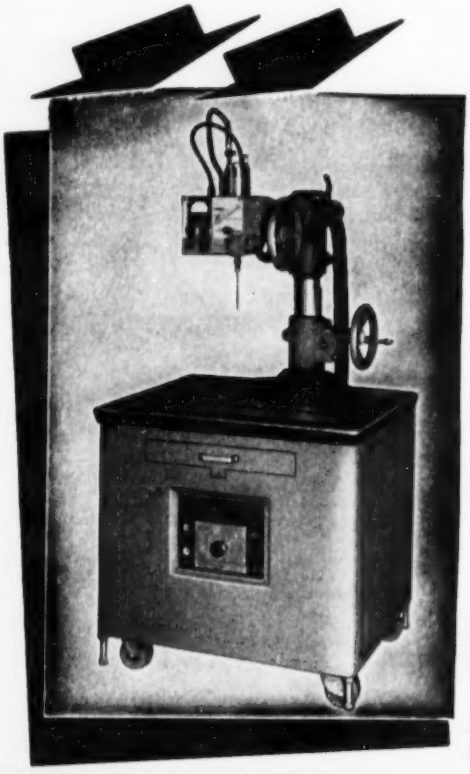
Cut oil holes in hardened gears without annealing



Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

There's a technical engineer in your area to give you an on-the-spot demonstration in your own plant at your convenience. (NOTE: It is not uncommon to pay for a Metalmaster with just one short demonstration thru savings on workpieces.)

SEE US AT THE CLEVELAND SHOW BOOTH NO. **2340**

For information as to the Metalmasters' uses and benefits merely write today on your company letterhead to:

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DIVISION OF CLINTON MACHINE COMPANY

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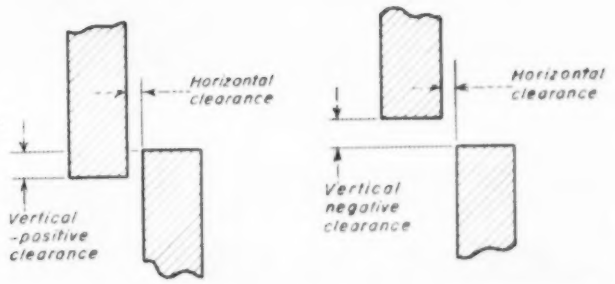
Rotary Shear Knives

Courtesy: Simonds Saw & Steel Co



Slitting, or rotary shearing, of strip to desired width for specific press tools is being more widely used by industry in order to simplify material stocking problems and to avoid paying mill extras. The plant doing its own slitting must, however, use care in setting shear knives.

The setting of the knives is important for satisfactory results. There are two clearances to be considered: horizontal clearance and vertical clearance. Opinions vary as to the amount of these clearances and they are best determined by experiment. However, the following rules are fairly accurate:

HORIZONTAL CLEARANCE

For material 0.020 in. thick and over, set clearance 8% of thickness of stock.

For material under 0.020 in. thick, use:

STOCK, IN.	CLEARANCE, IN.
0.010-0.018	0.00075-0.001
0.006-0.010	0.0005 -0.00075
0.006 and under	Zero Clearance

VERTICAL CLEARANCE

The knives are over-lapped or have a positive clearance for material less than 0.150 in. thick. For heavier material, knives are separated or have a negative clearance.

For material 0.010 to 0.050 in. thick, over-lap one-half the thickness of stock. For other gages overlap or separate knives to provide these clearances:

MATERIAL, IN.	CLEARANCE, IN.	
0.060	0.022	positive
0.070	0.020	"
0.080	0.175	"
0.090	0.015	"
0.100	0.0125	"
0.110	0.010	"
0.120	0.0075	"
0.130	0.005	"
0.140	0.003	"
0.150	0.000	"
0.160	0.0015	negative
0.170	0.003	"
0.180	0.005	"
0.190	0.007	"

Allowance should be made for spring of shafts, which sometimes occurs due to the equipment and to thickness and type of material being sheared. Closer adjustment to compensate for such a condition is sometimes necessary.

All the knives in a gang should be kept sharp, free from nicks, and the same diameter. When sharpening, knives should be ground on periphery only—never on sides.

Wickman DIAMOND WHEELS

(RESINOID-BONDED & STEEL-BONDED)

for Free Cutting... Quality Grinding... Longer Life

WICKMAN resinoid-bonded diamond wheels are recommended for use where extremely fast, free cutting action is most important. They can be supplied in a full range of types and sizes.

WICKMAN-NEVEN steel-bonded diamond wheels are practically indestructible. Diamond particles stay in place until worn, thus eliminating expensive loss of unexpended diamonds. These steel-bonded wheels are noted for their long-life and the extra number of tools they grind.

WICKMAN steel-bonded chip breaker diamond wheels have an unusually long service life. They will cut standard depth chip breaker grooves in carbide tools *in a single pass*. 1½-2 minutes is required for average size tool.

All standard shapes, types, and sizes of Wickman diamond wheels are available. Regardless of your cutting or grinding operation, it will pay you to investigate their quality features.

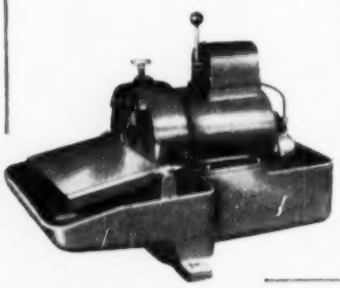
Wickman-Neven BENCH GRINDERS

for Maximum Efficiency

Wickman-Neven bench machines are designed especially for grinding and lapping carbide tools with steel-bonded diamond wheels. Both grinders feature built-in coolant pump and 1-HP full reversing motor in addition to many other advanced design features. You can be sure of highest efficiency and economical usage of diamond wheels with these bench machines that cut grinding costs.

OFF-HAND CARBIDE GRINDER

Model GF-2 bench machine provides maximum convenience, accuracy and speed when sharpening either left- or right-hand tools. Angular table adjustments from 5° above to 15° below horizontal can be quickly made. Compactly built (16½" wide x 26½" deep x 16½" high) this sturdy grinder will give many years of heavy duty service.



UNIVERSAL TOOL & CUTTER GRINDER

Model GF-3 has a swiveling motor head and a swivel table with vertical, longitudinal, and transverse movement. This fully universal tool and cutter grinder can be utilized for cutting off, chip breaker grinding, or general tool grinding. Standing 31¾" high, this grinder requires a 30" x 30" table area.

THE Wickman MANUFACTURING CO.

10325 CAPITAL AVENUE

OAK PARK (Detroit 37), MICH.

American Machinist

REFERENCE BOOK SHEET

Economic Lot Sizes...I

BY V G HOTCHKISS

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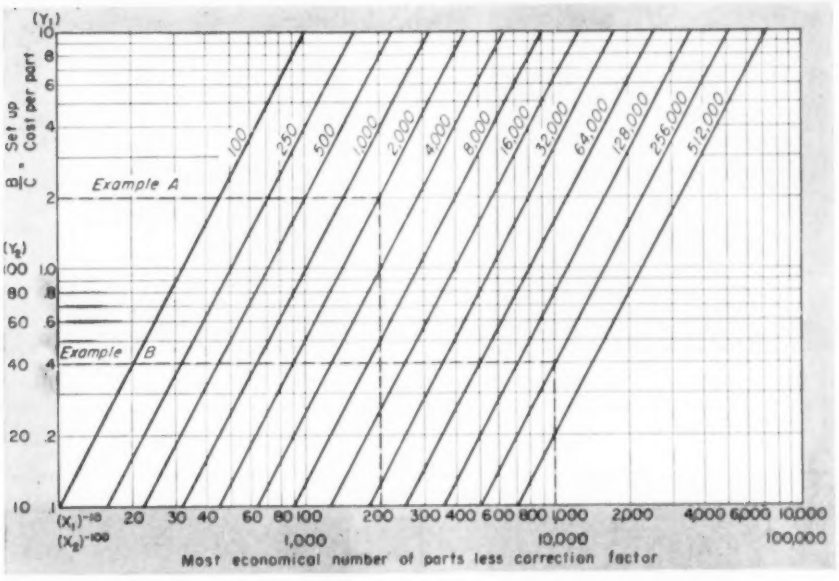
MOST ECONOMICAL NUMBER OF PARTS TO RUN WHEN A = 20%



Nearly all manufacturing companies are confronted with the problem of determining how many pieces of a given kind should be made at one time, before setting up the machine for a different part. Usually, the most economical number of pieces, or the economic lot size, is determined by a formula that balances the cost per piece for setup against the cost per piece for storage, insurance and interest on money invested. Usually, the most economical number of pieces Q is found by formula (4). Actually, a correction factor is needed, because, first, this formula assumes no parts are being consumed while the parts run is underway, and second, annual requirements may be incorrectly stated. For example, if 10,000 parts are needed per annum, but these parts are made in a 100-day period, production must be setup at the rate of 10,000 × 255 ÷ 100 = 25,500 pcs per annum.

Let us analyze the problem and derive a formula and chart that will solve the economic lot size accurately.

Let Q = Most economical number of parts
B = Total cost of setup
F = Number of parts used per productive day
D = Number of parts that can be made per productive day
C = Total cost of material, labor, overhead per part
A = Per cent by which the cost of the part is increased, because of value of floorspace, insurance, and interest on money invested

$\frac{B}{Q}$ = Cost per part for setup

$\frac{Q}{D}$ = Number of days required to use the parts

$\frac{Q}{F}$ = Number of days required to make the parts

(1) $\frac{Q}{F} - \frac{Q}{D}$ = Number of productive days *last* part made would be in storage

(2) 0 = Number of productive days *first* part is in storage

Average days the parts are in storage equal the sum of (1) and (2) divided by 2

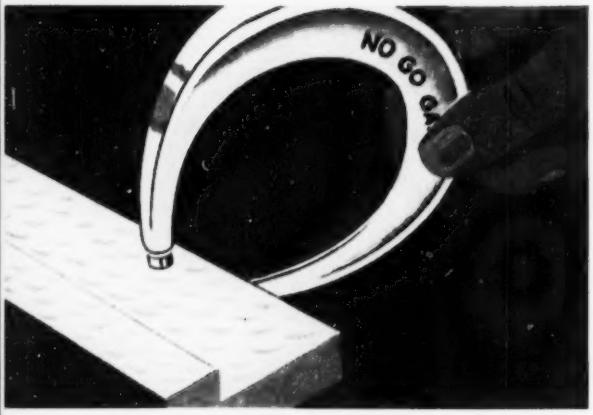
$$\text{or } \frac{\frac{Q}{F} - \frac{Q}{D} + 0}{2}$$

Based on 255 productive days per year, the average years in storage would be

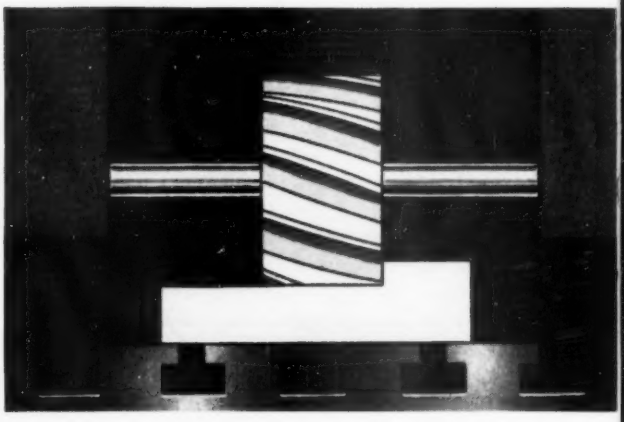
$$\frac{\frac{Q}{F} - \frac{Q}{D}}{2 \times 255}$$

HOW TO END DAMAGED WAYS, PRODUCTION LOSSES

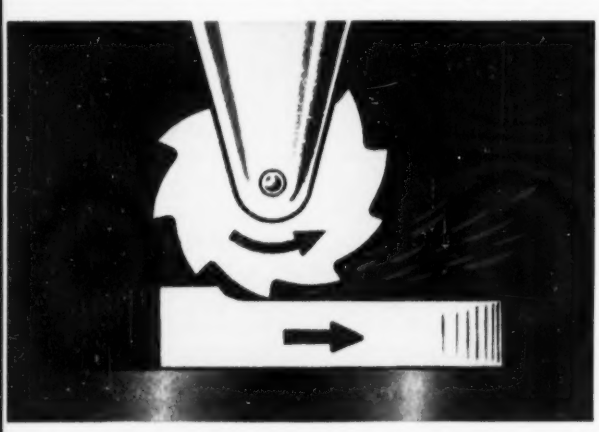
Sunoco Way Lubricant Stops "Jumpy Table"



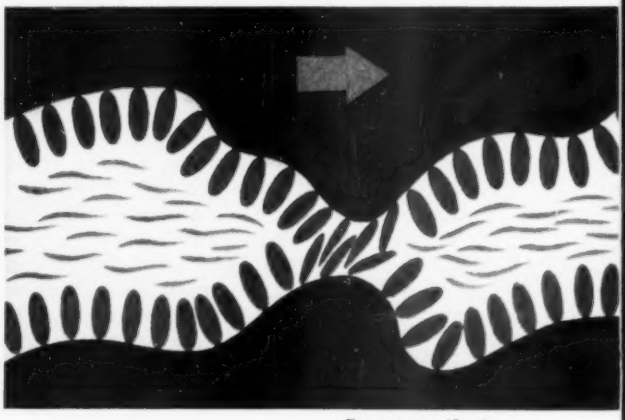
Tool chatter and jumpy table are machining headaches. Too often they cause poor surface finish, failure to hold tolerances, production losses.



Tool chatter is a result of a lack of rigidity in either the machine or the set-up. It is a mechanical problem and no lubricant can lick it.



Jumpy table is a stick . . . slip . . . stick . . . slip action of the table. It is a lubrication problem. Though just as damaging as tool chatter, it is not always detected when the cause of poor surface finishes.



Extreme magnification

Sunoco Way Lubricant cures jumpy table. It contains special compounds that form a film, like the nap of a rug, on the sliding surfaces and minimize the force of both static and kinetic friction.

Why take a chance of damaging your ways? These integral parts of the base casting for your machine are difficult to refinish and costly to replace. For information about Sunoco Way Lubricant, call a Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-8.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

Economic Lot Sizes...II

Cost of one part if in storage one year would be

$$C \times A$$

Therefore, when the setup cost per piece equals the storage, insurance, and interest cost, we have an equation that can be solved for Q, or

$$\frac{B}{Q} = \frac{\left(\frac{Q}{F} - \frac{Q}{D}\right) C \times A}{2 \times 255}$$

$$\frac{B \times 510}{C \times A} = Q\left(\frac{Q}{F} - \frac{Q}{D}\right)$$

Multiply both sides of the equation by DF will not not change its value; then, cancel denominators on right side of equation.

$$\frac{B \times 510 \times DF}{C \times A} = Q\left(\frac{DFQ}{F} - \frac{DFQ}{D}\right)$$

$$\frac{B \times 510 \times DF}{C \times A} = DQ^2 - FQ^2 = Q^2 (D - F)$$

$$\frac{B \times 510 \times DF}{C \times A (D - F)} = Q^2$$

$$(3)\quad \sqrt{\frac{B \times 510 \times DF}{C \times A (D - F)}} = Q$$

Equation (3) is sometimes expressed loosely as

$$(4)\quad Q = \sqrt{\frac{2B \times \text{Requirements on Annual Basis}}{C \times A}}$$

because $F \times 255 =$ Annual requirements
However, the latter equation assumes that no parts are being produced and used simultaneously, which is seldom the case. Also, if 5,000 parts are needed in 180 days, this must be converted to 7,100 parts in 255 days on an annual basis.

Equation (3) can be written as follows:

$$Q = \sqrt{\frac{2B \times \text{Annual Requirements}}{C \times A}} \times \sqrt{\frac{D}{D - F}}$$

The correction factor for equation (4) is $\sqrt{\frac{D}{D - F}}$

As F approaches D in size, the correction factor will become greater. If F is 0, the correction factor will be unity.

The following graph will give the most economical number of parts to produce, assuming $A = 20\%$. Similar graphs can be developed for others values of A.

Note: X_1 is read with Y_1, X_2 is read with Y_2

Example I:

$B = \$5.00$
$C = \$2.50$

then $\frac{B}{C} = 2$

$F = 8$, or 1000 parts in 125 days
$D = 16$
$A = 20\%$

Annual requirements $= 8 \times 255$ days $= 2040$
Most economical number of parts from graphs $= 200$

but $\sqrt{\frac{D}{D - F}} = \sqrt{\frac{16}{16 - 8}} = 1.41$ correction factor

$200 \times 1.41 = 283$ parts

Proof, using equation (3)

$$Q = \sqrt{\frac{B \times 510 \times DF}{C \times A (D - F)}}$$

$$= \sqrt{\frac{5.00 \times 510 \times 16 \times 8}{2.50 \times .20 \times (16 - 8)}}$$

$$= \sqrt{\frac{326400}{4}}$$

$$= \sqrt{81600}$$

$$= 285 \text{ parts}$$

Example II

$B = \$10.00$
$C = \$\ 0.25$

then $\frac{B}{C} = 40$

$F = 1000$, or 128,000 parts in 128 days
$D = 3000$
$A = 20\%$

Annual requirements $= 1000 \times 255 = 255{,}000$
Most economical number of parts $= 10{,}000$

but $\sqrt{\frac{D}{D - F}} = \sqrt{\frac{3000}{3000 - 1000}} = \sqrt{\frac{3}{2}} = 1.23$

$10{,}000 \times 1.23 = 12{,}300$ parts

Proof, using equation (3)

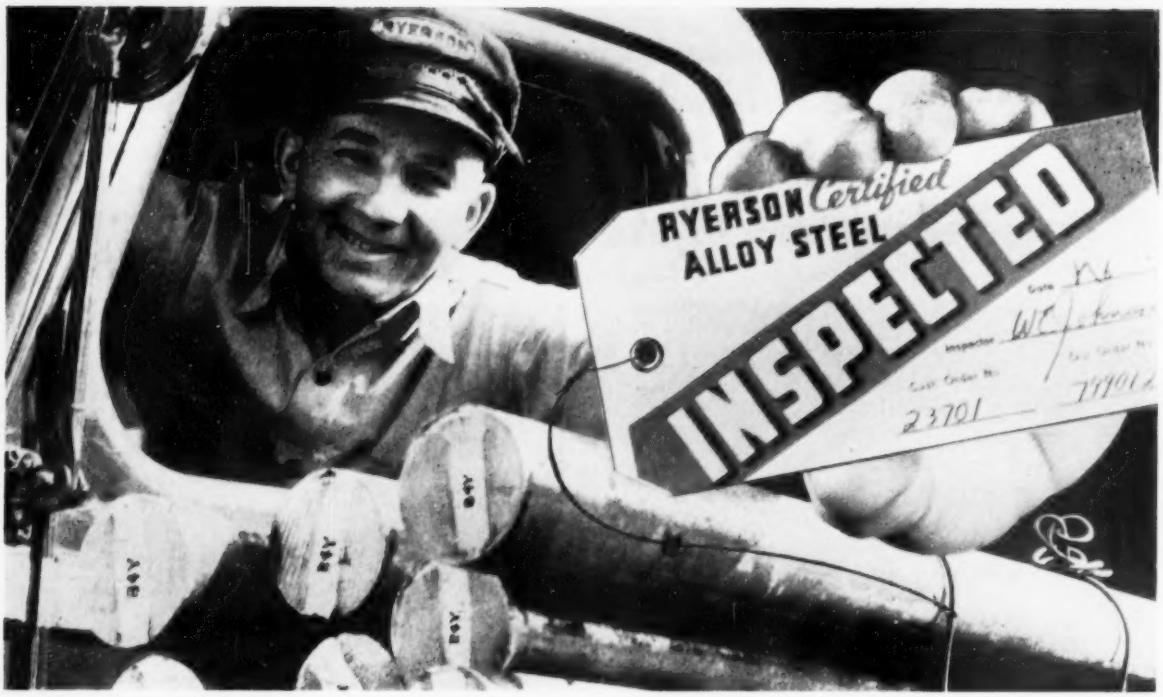
$$Q = \sqrt{\frac{B \times 510 \times D \times F}{C \times A (D - F)}}$$

$$= \sqrt{\frac{\$10 \times 510 \times 3000 \times 1000}{\$.25 \times .20 (3000 - 1000)}}$$

$$= 1000 \sqrt{153}$$

$$= 1000 \times 12.37$$

$$= 12{,}370 \text{ parts}$$



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eliminated

by Ryerson 8-step quality control

Two bars of steel may look alike—may actually have been bought as the same alloy—but even seemingly identical bars may vary widely in analysis and performance. To remove completely the risk of getting steel that will not perform as you expect it to—we developed the Ryerson Certified Alloy Plan.

Under this unique Ryerson system of quality control, your protection begins with the careful selection of heats to be carried in stock. Next, we verify the analysis of each selected heat. Then, after spark testing to guard against mixed steels, we permanently identify each bar with a stamped heat symbol and color marking. Meanwhile, we test a sample of every heat for hardenability and interpret the test results for you.

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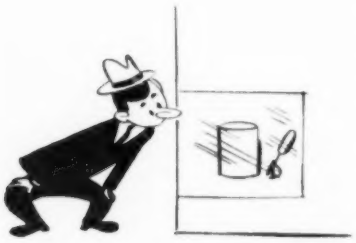
TALKING SHOP



Cornerglass

ALFRED UNIVERSITY (NY) had a distinctive idea in its new Ceramics Building—the cornerstone is solid glass, so you can see within it the brass cylinder containing the peculiar things that people always put in cornerstones. Corning Glass produced the "stone"—and the cylinder, a strictly Metalworking product.

Personnel Director

ASSOCIATED INDUSTRIES of Cleveland, in a recent survey of 333 member companies, discovered that union organization drives begin after companies have 50 to 100 employees, but that personnel administration remains decentralized. A personnel director is hired when employment is over 100—usually about 250.

Present Cleveland wages average $1.83 per hr on a 40-hr non-overtime week—the Bureau of Labor Statistics reports $2.01 as the total including fringe benefits. Wages have risen from $1.54 to $1.83 since 1950, and the "extras" have really blossomed. A third of Cleveland companies now pay for group life insurance, another 135 contribute—and to larger policies than of old. On other forms of insurance, similar liberalization has occurred. In 1950, only 49 companies gave sickness and accident insurance; 141 more contributed. Now 109 give it, 104 others pay part. And the extent of protection has increased from 13 to 26 weeks.

Checks and Kit

CONVAIR SAN DIEGO has instituted a new system of checking out perishable tools, devised by Marshall Aker, tool-service general foreman. The system involves standard tool kits for various job classifications, plus issuance of five plastic checks to be used for special tools. Previously, employees drew tools from cribs as they needed them, and no adequate check could be maintained. Now inventorying is a much simpler job, and stocks on hand are far smaller. Also, tools do not become interchanged between cribs.

Press-Slide Adjustment

WHEN YOU BUY a press, remember that a motorized adjustment for the ram is a great timesaver during new setups. But a motorized adjustment must have enough capacity to handle the heaviest punchholder that will be attached to the slide, and it should be capable of making the adjustment speedily. To be on the safe side, specify motor capacity great enough to handle a load 50% more than expected. You have got to raise the ram plus punchholder, and also overcome friction on the die's guide pins and the ways of the press.

Free Shine

BOWLING ALLEYS in the basement at Woodward Governor Company, Rockford, Ill., had to make way recently for production equipment—sales were exceeding plant capacity. However, a partial replacement has proved even more popular—a 2-chair barber shop where "associates" in the company get haircuts and shines on the house.

No Stock to Spare

ONE AIRCRAFT ENGINE manufacturer is said to be cast-iron lapping the journals of the jet turbine shaft. Because tolerances of the part are so close, grinding was felt to be too risky for volume production with relatively inexperienced operators. Stock is removed slowly with the lap, and frequent measurements can be made as the part approaches size. The result is that the parts, each worth several thousands dollars at this stage of manufacture, are much less likely to be scrapped for that extra half a tenth which somehow became 0.00006.

Warning—Keep Off

GM's "FOLKS" MAGAZINE for August carries an article on automotive history, and includes the point that Europe never got into real mass production because of private monopoly and government regulation, based on: "markets are limited so overproduction must be avoided."

Expert Solution

VISITING EXPERT checking faulty operation of a tricky machine tool found that lubrication on a long shaft was too heavy, causing sticking. He called for a lighter oil, which the lubrication "engineer" provided by cutting the original with kerosene, instead of finding the proper viscosity. To top it, the works manager—a strictly executive type—commended him on his knowledge and adaptability. Now the lube man brags to his pals how he's a friend of the management—and the oil on that sticky shaft varies day by day toward further trouble.

Blind Assembly

MONETT HOUSE, 221 E Mound St, Columbus, Ohio, is the site of an unusual experiment. There 14 blind workers, under guidance of the Columbus Assn for the Blind, are assembling six million washers to bolts for the Steel Co of Ohio. More could be used, but a current bus strike makes it impossible for others to get to work. The job is done on a piecework basis. Average daily production is 4000 assemblies, best is 6000. This job, to bring $9000 total, is the largest thus far undertaken in the project, designed to help the blind help themselves.

Industry's Worst Fire Razes $75-Million

DETROIT—Between 15-20% of total US passenger car production, mostly in the higher-price brackets, halted as the result of a fire that gutted General Motors Corp's $75-million automatic transmission plant at Livonia, Mich, August 12. The plant was the sole source of Hydra-Matic transmissions for GM's Cadillac, Oldsmobile and Pontiac cars, and for Lincoln, Hudson, Nash and Kaiser-Frazer.

How It Started

The fire raced through the comparatively new (four years old) Livonia plant late in the afternoon of Aug 12. Stories on its origin vary widely and the true version may never come to light. This is the most widely accepted story:

Sparks from a welding torch fell into a drip trough under an overhead conveyor, and oil and cleaning solvent drippings caught fire. The flames raced along the trough to a solvent tank, which exploded, spreading fire through the unpartitioned plant.

When this happened, operators ran for the exits, leaving their machines operating. No one shut off the main electrical supply, and short circuits exploded the transformers. As the heat intensified, the plant's wooden floor caught fire and a half-inch layer of tar on the roof melted and ran down into the shop. A west wind blew most of the flames and heat toward the plant's east side. Thus most salvageable machines are located on the west side. The intense heat split screw machine and turret lathe beds.

Fire Facilities Inadequate

The holocaust is said to have swept through the 1.5-million-sq-ft building so fast that office workers were momentarily trapped in their area. A telephone call to the fire department had to be made from a filling station across the street, lines having already burned out in the plant. Inadequate local firefighting facilities failed to check the blaze in any appreciable way.

Six persons lost their lives in the fire or as a result of it. Three died in the fire, a fireman died of exhaustion, and two men were electrocuted a few days after the fire when they drove a bulldozer into a 40,000-volt live cable.

Less Than 10% Salvageable

There was no firm estimate of the damage to plant or equipment; unofficial figures ranged from $40- to $70-million. Less than 10% of the plant's 6000 machine tools are salvageable, say top production officials and machine tool makers.

Within a week after the fire, GM had a well-prepared disaster control and salvage program in operation. The company's top master mechanics and tooling experts were working as a team, supervising salvage work. Machine tool builders and tooling vendors were brought in by categories to discuss rehabilitation and orders for replacements were being given.

As the ruins still smoldered—on

THE GM FIRE AFFECTS:

- **NEW MODEL OUTLOOK: the GM fire puts a seven-day-a-week load on a number of machine tool builders and tool and die shops . . . they will give top priority to Hydra-Matic work over GM and non-GM 1954 new model programs.**
- **OTHER INDUSTRIES: The importance of resuming Hydra-Matic production on US economy is so great that orders for machinery and tools from non-automotive sources will take a back seat.**
- **AUTO PARTS MAKERS: Hundreds will lose major customers for many weeks. Some will offset this by Hydra-Matic parts making.**
- **STEEL INDUSTRY: Loses temporarily one-fifth of the sheet and bar stock used by its largest consumer — the automotive industry.**
- **TRANSPORTATION INDUSTRY: Loses in two ways — (1) haulage of materials and parts, (2) transport of new cars.**
- **DEALERS for the affected lines will have fewer cars to sell. Other lines should move faster. Used car prices will firm up. Temporarily, there may be twice as many buyers for fine cars as there are cars.**
- **LABOR: Many thousands of auto workers have been laid off at GM and other affected manufacturers and their suppliers.**
- **THE PUBLIC — can figure on paying more for both new and used cars. And it may have to wait quite a while to get the cars of its choice.**

Bulletin

DETROIT—General Motors Corp has announced that Dynaflow transmissions will be used on Cadillacs beginning on or about September 8. Informed sources anticipate that Dynaflow transmissions will shortly be used on Oldsmobiles and that Chevrolet's Powerglide will go into Pontiacs. Thus production can be resumed on all three lines within two months, cutting anticipated losses of 20,000 GM cars a week.

Buick's Dynaflow production will be expanded rapidly to permit its use on Cadillacs and Oldsmobiles, probably at some expense to Buick production. Part of expanded Dynaflow production will be used on Buick Specials to free more synchro-mesh transmission facilities for Oldsmobiles.

Powerglide production will also be expanded, but it is understood that conversion plans are lagging behind those for Dynaflow.

No indication has been given as to whether non-GM customers will be served.

GM Automatic Transmission Plant

August 17—demolition crews had worked in about 20 ft from the four corners and sides of the building, uncovering and inspecting equipment. Damage varied widely—some machines had their tables melted off, while only 15 ft away an identical machine would appear to have been only blistered. One line of 70 Fellows gear shapers was distorted beyond salvage.

Builders Reworking Tools

Gages, tools and machines deemed salvageable were being shipped out for rework at week's end, with some tool builders receiving scores of machines for rebuilding. Work is ordered done on a 7-day week basis, cost plus. GM has asked every master mechanic in its organization to try to make Hydra-Matic parts, and outside parts makers are being urged to do the same.

May Take Year to Replace

As fast as a machine tool is pulled out of the ashes, it is shipped to the original manufacturer, uninspected, to see if it can be rebuilt. If it can't, the machine tool builder immediately advises GM and a new replacement is ordered if necessary. A large number of the machines involved in the Livonia fire were highly complex and specialized and could take a year or more to replace, even if production could be fitted into present backlogs.

Tank Equipment Burns

Machine tools used by GM's Ternstedt Division for manufacture of tank range finders, also burned out in the Livonia fire, will be comparatively easy to replace because most of them were standard units. But, like all other GM tooling and machine works, this operation's rehabilitation will take a back seat until the transmission facilities have been set up again.

Most Records Saved

All drawings and records of equipment installed two weeks or more before the fire were saved and microfilm copies are available. But equipment received within two weeks of the fire for manufacture of a new type of improved Hydra-Matic was destroyed and all records lost.

Cadillac, whose cars are 100% equipped with Hydra-Matic, suffers most from the fire. Oldsmobile and Pontiac, with 98% and 85% of their cars Hydra-Matic equipped, respectively, will be almost as badly off. Among non-GM users of Hydra-Matic—Hudson, Nash, Lincoln and Kaiser-Frazer—percentages ranged anywhere from 100% down to 30%.

Limited Production Oct 1

General Motors is shooting for limited production of Hydra-Matic by Oct 1 or earlier, and has negotiated with Kaiser Motors for an 18-month lease on its Willow Run plant, located only 20 min drive from Livonia—a distinct advantage for the Livonia plant's 8500 employees. Willow Run is still filled with government-owned machines

GM Fire (continued)

and materials used in producing C-119 transport planes, but the Air Force has assured GM of fullest cooperation in removing the machines and materials.

Obviously, it will be several months before full-scale production can be resumed, even if Willow Run is equipped with salvaged, rebuilt and new replacement equipment. To build a complete new plant, or two or more plants, would require at least a year.

GM stands to lose 20,000 cars a week ('53 models) for six weeks and less than this for another couple of weeks, or say 150,000 cars.

No '54's Until March?

Thus, instead of new model changeovers in late October or early November for January introduction, it is likely that production of '53 models will be resumed for two reasons: (1) to amortize '53 tooling and use up parts stocks on hand or committed, and (2) to allow Hydra-Matic production to build up during the last quarter so that '54 models can be supplied in sufficient quantities for stocking dealers and supplying initial demand. Therefore, introduction of Cadillac, Oldsmobile and Pontiac '54 models may not come before next March.

Alternatively, GM is said to be studying the possibility of using its other type of automatic transmission, Dyna-Flow, on the three affected makes.

Lincoln, 100% equipped with Hydra-Matic, was forced to taper off as its co-Ford product, Mercury, a non-user of Hydra-Matic, stepped up production to fill the gap. Hudson, down for model changes, is in almost as bad a spot—over 75% of its larger models and 30% of its Jets are Hydra-Matic equipped. Nash, down for inventory, supplies an important part of its production with Hydra-Matic. Kaiser is closed and when production will be resumed is anybody's guess.

Sales Loss Great

Whatever loss was incurred in the fire for machines, equipment, and plant is as nothing alongside the sales and profit losses that GM will suffer. For every 100,000 cars lost to production, the net sales loss to GM can be estimated at around $250,000,000. Say the transmission production is shut down for three months—the loss in volume would at least be double 100,000 cars, maybe much more.

All machine tools, so far as a quick look through the plant went, had lost their electronic and electric controls. These burned out under the terrific heat that buckled girders and brought steel to cherry red temperature. The fire appeared to have ignited much cutting oil and the chips in them, bringing flames right up to a large number of the machines.

Ways had been distorted by this heat on many of the machines. Tooling on them, of course, was materially damaged, probably much of it beyond repair, inasmuch as the close tolerances required for many of the transmission parts were thrown completely out of kilter.

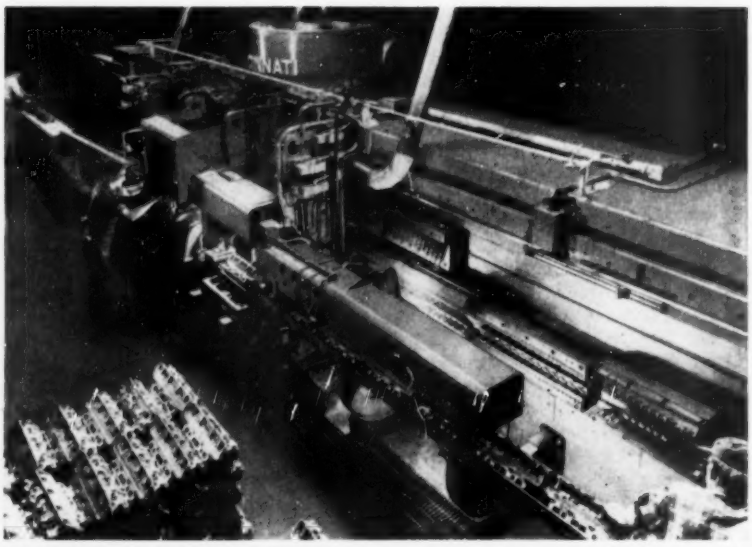
The important thing to remember is that tooling, more than machine tools, probably will prove the large problem. Tools and fixtures on the machines have probably largely been wrecked. Their replacement will take a good deal of time. In addition, GM will almost certainly pull in from other divisions all machine tools which can be used in the transmission operation. So it would appear that tooling becomes the big

Buick's New V-8 Engine Plant Steps

FLINT, MICH.—Production of V-8 engines at Buick's new plant here has reached 1200 units a day. Designed to produce enough engines to supply an annual output of 750,000 Buicks, a figure predicted for 1960, the plant has provided engines for about 193,000 cars during the first seven months of this year.

Occupying 850,000 sq ft of floor space and equipped with upwards of 2000 machine tools, the V-8 plant employs high-speed machining techniques to achieve high output. Cylinder heads and blocks are machined on automatic transfer lines, some of which are 140-ft long and perform 27 operations.

Giant 100-ton broaches machine all sides of cylinder blocks and heads in a single operation. Other automatic operations: a machine that makes 3000 valve pushrods an hour; a gear cutter that cuts teeth in 14 flywheel ring gears in a single operation.



BROACHING V-8 ENGINE HEADS on a 45-ft long, 75-ton fully automatic broach. Scrap drops through grid on floor, is conveyed to storage bins

bottleneck in plant rehabilitation.

Top Tool Priority

Tool shops and machine builders will give the Hydra-Matic job the green light over all other projects —GM or otherwise—and this will probably delay '54 tooling for non-GM makes if the competitor models are not already completed or in an advanced stage that will permit completion of tooling in the companies' own toolrooms.

Automotive competitors, machine tool producers and suppliers of all sorts poured in offers of help on General Motors. Space for manufacturing was offered in Detroit, equipment was tendered, and assurances of night-and-day activity to make needed replacements were heard on all sides.

In the wake of the fire came immediate schedule curtailments in various GM plants. Cadillac worked but five hours the day after the fire, and appeared headed for complete and early shutdown. Some 8500 people are employed there. Hinged to these schedules are operations at the Fleetwood body plant, with another 4100 people. With Cadillac 100% equipped with Hydra-Matics, there was no hope for much production in that quarter.

Olds and Pontiac were almost as badly off. Pontiac closed its assembly line on Friday, Aug 14, the second day after the fire, but maintained manufacturing operations in the rest of the plant for the time being. Some 1500 assembly line workers were laid off. The Fisher-Pontiac plant and the Fisher fabricating plant at Pontiac, both largely tuned to Pontiac output, moved in tandem with their 4800 people.

At Lansing, the Olds Motor Div closed Aug 14 and Aug 15, laying off 12,000 people. Fisher-Lansing, with 4800, followed suit. Olds expected to get in four days of work after Aug 15, but prospects beyond that were thin; much more than half its output is normally Hydra-Matic equipped.

Retooling May Take Year

The cry for tools and gages to re-equip Hydra-Matic production will undoubtedly affect the tooling plans of all producers. Several million dollars worth of such equipment can't be made overnight, and the tool and die industry in Detroit is just recovering from a major strike. Experienced observers confirm this. Their estimate: GM won't get back up to its normal 4600-a-day Hydra-Matic production for at least a year.

AIR MATERIEL COMMAND DROPS SUB-HEADQUARTERS

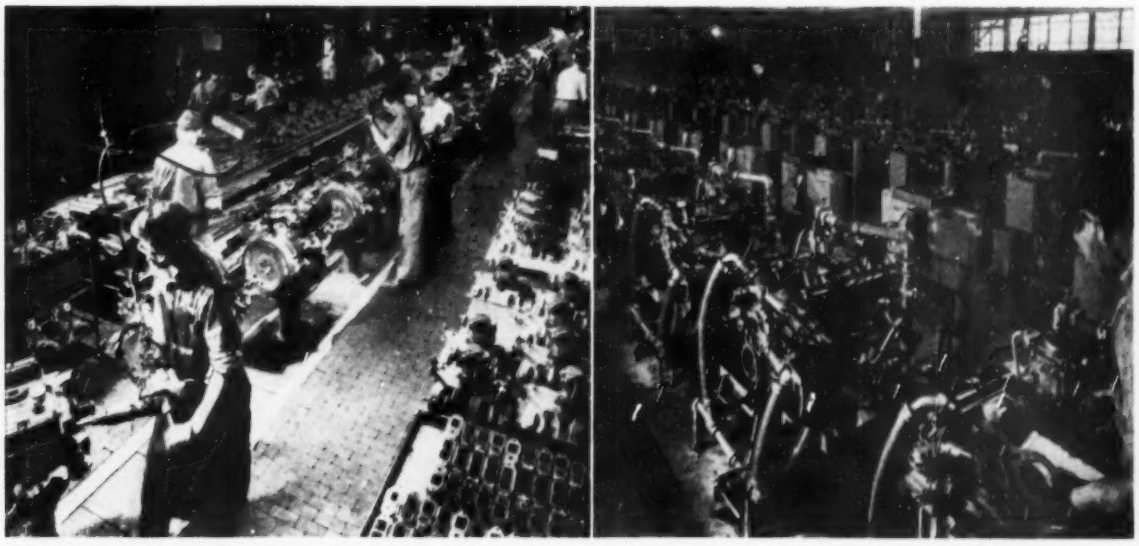
WRIGHT-PATTERSON AFB, OHIO —Air Materiel Command will eliminate seven subordinate headquarters by December 31. This is expected to free critical manpower for other USAF projects.

The subordinate headquarters are: Eastern Air Procurement District, New York; Northeastern APD, Boston; Central APD, Detroit; Midcentral APD, Chicago; Southern APD, Fort Worth; Western ADP, Los Angeles; and Olmsted Air Force Base, Middletown, Ohio.

These headquarters administer over 14,000 USAF contracts, valued at $16.86 billion. Under the reorganization, field supervision of contract administration will pass to AMC's eight Air Materiel Area organizations: Middletown AMA, Middletown, Ohio; Mobile AMA, Brookley AFB, Ala; Warner Robins AMA, Kelly AFB, Texas; Ogden AMA, Hill AFB, Utah; Sacramento AMA, McClellan AFB, Calif; San Bernardino AMA, Norton AFB, Calif.

The organizational change will have no effect on the present method of contract placement. Changeover to the new setup will be made without service interruption.

Up Production To 1200 Units a Day



ASSEMBLING AND TESTING V-8 ENGINES. Left: Buick's Flint plant has two 600-ft assembly lines, fed by 2½ miles of overhead conveyors. Right: each engine is given a break-in run before installation. Total engine test hours a day: 400

Pentagon Economy Drive May Kill Vance Plan, Cut Ammunition and Hard Goods Production

WASHINGTON — Eisenhower Administration's new economy drive will fire up the machine-tool and metalworking industries. An order issued jointly by the President and Budget Director Dodge told government agencies "cut your 1955 budget as much or more than your 1954 budget."

Metalworking Affected

This continuing pressure to cut spending and balance the budget hits metalworking two ways:

- It may well spell the complete end of the Vance Plan to create standby defense production lines.
- It again puts the squeeze on Pentagon spending generally, including hard goods, at a time when the new Joint Chiefs of Staff are re-surveying US defense needs.

The feeling is that Defense Secretary Wilson will find this new budget order an ideal excuse to drop the Vance Plan—now figured at $250 million. Wilson has never been much in favor of standby defense production facilities.

Of course there will be other economy cuts, too. But dropping the Vance program is the biggest one in the metalworking field and is the last big chunk of money that Wilson can whack off without the men in uniform raising a really big furor. Actually, the biggest cutbacks in orders for hard goods have already come about. There's a lessening of tank and military vehicle production. And there'll be further whittling next spring.

Depreciation Responsible

The important thing to remember, though, is that these cuts are not so much the effect of budgetary limitations or results of the shooting war's end in Korea. They are caused mainly by rapid depreciation of inventory in war reserves and by troops. This fall and next spring were to have been slowing-down periods in the arms production program, regardless of consequences.

The new economy drive has Washington worried. Republicans were able to make big slices in the Truman spending program, amounting to more than $4.5 billion. Dodge wants to cut that much again for fiscal 1955. But speculation is that it will be next to impossible to get. Reason is that the departments are already being pared to the bone. And the new bosses are just getting around to thinking maybe they ran the skinning knife too deep in some cases.

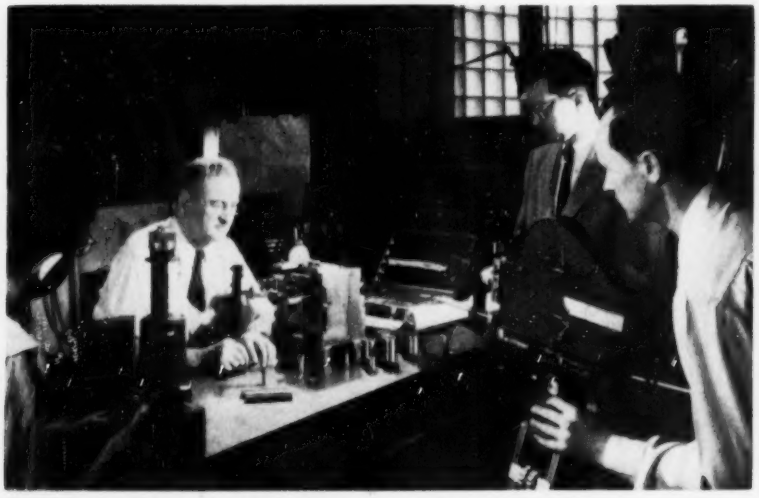
Dodge is talking tough for two reasons: (1) he's hoping the administration can get through the year without exceeding the debt ceiling, and (2) he knows there's little chance of balancing the budget next year.

Security vs Economy

One problem for the Republicans: a fiscal straightjacket on Defense Department spending could mean less security. And top administration leaders, including the President, have promised that they will not economize at the expense of endangering the nation. The new Joint Chiefs of Staff, now reviewing the entire military picture, may come up with recommendations for more—not less—military spending.

However, a few cuts loom in the defense program. Ammunition contracts will have to be eased off because of the at-least-temporary lull in Korean shooting. Reason is that ammunition expansion came too fast after the shortages investigation, and the military is now getting ammunition deliveries at an alarming rate. Even with diversion of shipments to Europe and elsewhere, it will still be necessary to cut output within the next three months.

Scenes from NTDMA's New Film



FILMED AT TOOL AND DIE SHOPS in the East and Midwest, the NTDMA-sponsored sound-color film, "Tool and Die Making—Keystone of Mass Production," will be premiered in New York September 16. Designed to acquaint businessmen, government and the public with tool and die making processes and their role in world economy, the film empha-

Carpenters' Withdrawal from AFL Strengthens IAM's Labor Position

WASHINGTON — The International Association of Machinists stands to benefit from the withdrawal of the Carpenters' Union from the American Federation of Labor. Whether this means more or less trouble for those employers who get caught in the middle of jurisdictional fights between the two unions remains to be seen. It probably won't make much difference.

For the first time in more than 10 years, IAM, the self-styled second largest AFL union, will have a voice in the AFL Executive Council—IAM President Albert Hayes is slated to become an AFL vice president and council member after the AFL convention next month will increase the number of the Federation's vice presidents from 13 to 15.

This is a real advantage, particularly with the absence of a Carpenter spokesman on the council.

The Machinists, claiming 830,000 members against 822,500 for the Carpenters, quit AFL twice on grounds that AFL was not enforcing IAM's jurisdictional rights. The union returned to AFL in 1951 with a verbal understanding about its jurisdiction with relation to the Carpenters. But the problem was never really solved.

Today, with the Carpenters out of the AFL running, IAM will have full AFL backing in jurisdictional disputes. IAM is advocating that an impartial judge mediate any future jurisdictional disputes between the Machinists' and Carpenters' unions.

Lukens to Build Armor Plate Plant

COATESVILLE, PA. — A $10.5-million armor plate producing plant will be built here by Lukens Steel Co adjacent to its heat-treating plant. Authority for the new 1000-ft-long plant has been received from the Navy's Bureau of Ships and construction is scheduled to start in October. Modern equipment to be installed in conjunction with the Navy will include continuous heat-treating furnaces, a plate roller-leveler that can flatten 200-in.-wide, 2-in.-thick plates, a 5000-ton capacity press to flatten plate more than 2-in. thick, a shear that cuts plate up to 1.5 in. thick, a gas-cutting table, and latest developments in testing equipment.

AIEE MACHINE TOOL CONFERENCE OCT 14-16

CLEVELAND—Some 500 electrical and mechanical engineers from machine tool building firms, electrical manufacturers and large users of machine tools are expected to attend the Sixth Annual Conference on Machine Tools here Oct 14-16.

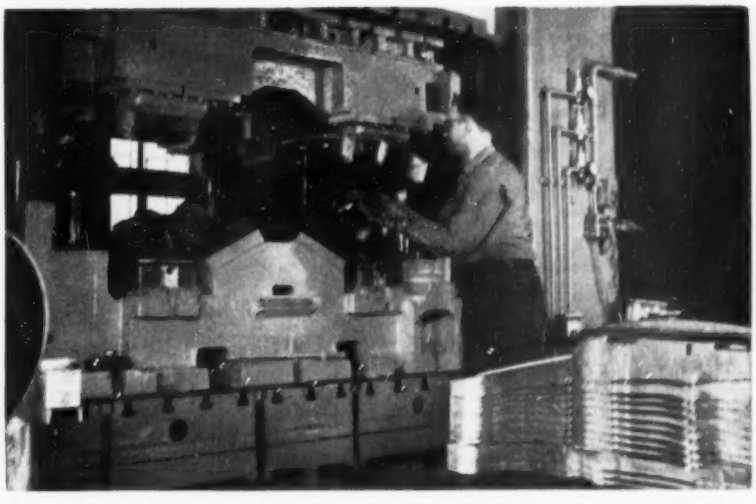
The Conference is sponsored by the American Institute of Electrical Engineers and will be devoted to increasing machine tool safety and productivity through electrification. Program will feature 11 technical papers, and plant tours of Ford's Engine Plant, Warner & Swasey, Chevrolet Transmission plant, and Reliance Electric & Engineering Company.

Featured banquet speaker will be Frederick S Blackall, Jr, Taft-Peirce Mfg Co, president of ASME.

International Controls On Nickel End

WASHINGTON — The International Materials Conference is closing up shop, ending its two-year allocation of nickel, the last critical metal under its control. At one time, IMC was severely criticized by the American automobile industry because of its US copper allocations, which Detroit claims were responsible for cutbacks in auto production. Important metals producing and consuming nations made up IMC committees responsible for setting up the controls.

on Contract Tool and Die Making



sizes the industry's high standards of craftsmanship by following an apprentice's progress through an 8000-hr course. Production procedures of such diverse items as automobile crankshafts and zippers are shown, as are the toolmaking practices upon which such production depends. Prints of the film will be available from NTDMA on a loan basis.

Roger S Pyne

Clarence H Smith

L B McKnight

J C Merwin

Names in the News

Roger S Pyne, formerly vice president in charge of the machine tool division of Van Norman Co, Springfield, Mass, has been named to head the engineering operations of the division. **Herbert L Freer**, production planning manager, has been named general sales manager, and **Edward C Hellyer**, previously production planning superintendent, has been appointed production planning manager.

I Melville Stein has been elected president of Leeds & Northrup Co. Formerly executive vice president, he succeeds **Charles S Redding**, who, after a 14-year term as president, has been named chairman of the board. **D H Schultz**, secretary and treasurer since 1940, takes over Mr Stein's post, while retaining the duties of treasurer. Vice President **George W Tall, Jr**, assumes the additional post of secretary.

F R Dickerson has been elected vice president and general manager of the Geo D Roper Corp, Pump Div, Rockford, Ill. Mr Dickerson joined the company in 1936, was appointed sales manager in 1948, and general manager in 1951.

Dr M C Teague has been named president of Lock Thread Corp, Detroit. Former President **Samuel J Metzger, Jr**, will continue as a director of the corporation. Prior to his appointment, Dr Teague had been associated for 33 years with US Rubber Co in the development, licensing, and sale of new products.

Clarence H Smith has been appointed assistant general superintendent of Studebaker's South Bend plants. A member of the organization for the past 28 years, Mr Smith has headed production operations at the Chicago aircraft engine plant since 1951. **Ernest M Riggleman**, former superintendent of daytime operations, will take over Mr Smith's duties, and **Guilford B Cook** moves up from superintendent of nighttime operations to Mr Riggleman's post.

Robert L Holloway has been named chief engineer of American Machine & Foundry Co's Buffalo plant. Formerly manager of the special projects and development section of the engineering department, Mr Holloway has been a member of the organization since 1946.

D E Gamble has been named chairman of the supervisory board, and **T L Knecht** named president and general manager of the Borg & Beck Div of Borg-Warner Corp. Mr Knecht, formerly vice president and general manager, succeeds Mr Gamble. **George W Borg**, previously supervisory board chairman, will head the executive committee.

G W Ballantine has been named to the newly-created position of manager of the coated abrasives department of Armour & Co's Alliance Div. In his new position Mr Ballantine will have full control over sales, promotion, buying, and research functions.

L B McKnight has been elected president and chief executive officer of Chain Belt Co, Milwaukee; he succeeds **J C Merwin**, named chairman of the board. Mr McKnight joined the company in 1927; in 1948 he was appointed vice president and director, and for the past two years has been serving as executive vice president.

Charles A Macfie has been elected president of Revere Copper & Brass, succeeding **James M Kennedy**, named chairman of the board and chief executive officer. **Raymond P Winberg**, vice president of the company's Rome, NY Div, takes over Mr Macfie's duties as general sales manager of all rolling mill sales. **Robert M Lake**, formerly Rome's sales manager, has been named to Mr Winberg's post as vice president of the division.

Herman L Weckler has been appointed vice president, operations, of Clevite Corp. He will be in charge of manufacturing and selling units, including Cleveland Graphite Bronze Co, Brush Electronics, Harris Products, Clevite Service, and Clevite Ltd, Canada. Formerly associated for many years with Chrysler Corp, he served as vice president, general manager, and director since 1940. During World War II he served, in addition, as president of the Dodge Div.

Henry W Fritz has been appointed midwest sales manager for the Quijada Tool Div, Gaines-Collins, Los Angeles. Associated for many years with the field of machinery production and distribution, Mr Fritz will represent the company's entire line throughout eleven states.

Joseph E Maurey

Theodore F Eserkaln

Whitfield J Bell

David H Paul

Joseph E Maurey has been named vice president and general manager of Maurey Manufacturing Corp, Chicago. **Russell B Malloy,** formerly district sales manager for Indiana, Illinois, and part of Michigan, has been appointed national sales and export manager.

William M Steffen has been appointed general supervisor of materials and process engineering for Northrop Aircraft, Hawthorne, Calif. Prior to joining the firm in April, Mr Steffen held a similar post at North American Aviation's Fresno, Calif, plant.

C I Bradford has been appointed vice president and director of operations, Rem-Cru Titanium, Inc, Midland, Pa. **W E Gregg,** formerly assistant treasurer, succeeds Mr Bradford as assistant director of operations.

Russell J Dickson has been appointed general sales manager, Leschen Wire Rope Div, H K Porter Co, St Louis. Formerly Chicago district manager, Mr Dickson will be in charge of the company's sales activities.

Don T McKone, Jr, has been named to head Aeroquip Corp's recently-acquired plant of Sterling Electric Motors, at Van Wert, Ohio. Mr McKone was formerly assistant general manager of Aero-Coupling Corp, Aeroquip's west coast subsidiary.

Robert E Kenngott has been appointed sales manager of Machine Tool & Supply Co, Tulsa, Okla. He was formerly machine tool engineer for Douglas Aircraft's Tulsa plant.

Theodore F Eserkaln has been appointed chief engineer of Kempsmith Machine Co, Milwaukee. For many years Mr. Eserkaln was assistant chief engineer of Kearney & Trecker Corp where he supervised development of equipment for high-speed carbide milling. Recently he served as director of engineering at the George Gorton Machine Co in connection with its product improvement program. He is a member of the Machine Design Committee of the ASME.

H J Holquist and **E J Richardson** have been appointed assistant managers of the cold finished bar division of Joseph T Ryerson & Son, Chicago. Both men have been connected with the division in a sales capacity, Mr Holquist at Chicago and Mr Richardson at New York. They will continue to make their headquarters at these points.

Fred A Milnes has joined the staff of Morey Machinery Co, New York. Mr Milnes, formerly associated with E W Bliss Co, and ALCOA, as chief tool designer and staff engineer, will head Morey's enlarged division of presses and associated machinery.

John H Harper has been named chief staff engineer of Acme Steel Co's Riverdale, Ill plant. Mr Harper joined the company in 1948; for the past four years he has served as assistant chief engineer in the Machine Design Engineering Dept.

Paul L Swoger has been named midwestern sales manager for American Metallurgical Products Co, Pittsburgh. He will operate out of Chicago, where he has been representing Vanadium Alloys Steel Co.

Whitfield J Bell, Norton Co abrasive engineer in Maryland and Delaware, has retired after 38 years with the firm. **David H Paul,** formerly of the Philadelphia area, will take over Mr Bell's territory.

A S Nippes has been appointed works manager of Elliott Co's Jeanette Division and will be responsible for all manufacturing activities.

John B Kohler, formerly president and chief engineer of The Kohler System Co, has opened offices in Crystal Lake, Ill. A specialist in machine design, process, and operating problems, Mr Kohler will provide consulting service to the paper, paper converting, and printing industries.

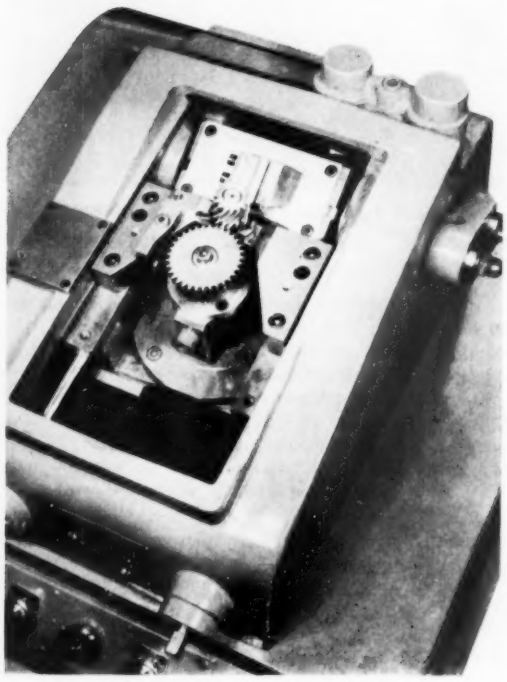
OBITUARIES

Donald H. Montgomery, 57, vice president and chief engineer of the New Britain Machine Co, died August 13 at Farmington, Conn. Well-known in the machine tool industry throughout New England, Mr Montgomery had been a member of the firm for the past 25 years.

Arthur A Hadden, 65, president of McClure, Hadden & Ortman, Inc, management engineering firm, died August 16 in Chicago. Head of the organization for the past nine years, Mr Hadden was named in 1945 one of the ten outstanding industrial engineers in Chicago.

Louis M Klinedinst, 70, former Timken Roller Bearing Co executive, died August 10 in Canton, Ohio. Mr Klinedinst retired from the company in 1948, but continued as a director and served as sales consultant.

New Shop Equipment



Burrs and Chamfers Entire Tooth Form

The Modern Industrial Engineering Co line of universal high-speed gear burring and chamfering machines will finish the entire tooth form of both helical and spur gears with pitch diameters from ⅝ to 9½ in. as well as external straight- and involute-form splines.

It is reported that chamfering both sides of the tooth and the root on one side of a gear takes less than 1/5 sec. Production rate for gears with 22 teeth is 600 per hr at 80% operating efficiency. Once the machine has been tooled up and started, it is not usually necessary to stop it to load and unload the work. Changeover time for tooling is said to require ten minutes.

The tooling illustrated consists of a pilot gear, work-holding fixture, toolblock, and form cutter. Tooling developed for a particular job is tried out on a master machine in Modern Industrial's plant.

The precision-ground toolholder is keyed in two directions to insure positive positioning. Four socket-head screws hold the toolblock in position. Workholding fixture is located on mounting rails and positioned on hardened and ground dowels. It is also secured by four socket-head screws.

A ½-hp motor drives the machines, with two motors used on two-station machines. The motor pulley is belt-connected to a second pulley which is belt-connected to a third pulley mounted on a spline cross shaft. A bevel gear on this shaft meshes with a second spline shaft which carries the sliding index worm that operates the index worm gear. The worm gear shaft carries the pilot gear. All ratios, from the spline cross shaft to the pilot gear, are 1:1. An over-riding clutch located in the final pulley hub prevents damage to cutter or machine in event of jamming.

Operation, once machine has been tooled up, consists of placing gear on work spindle until indicator light notifies operator that cycle is complete. Mounting the gear activates an indicator arm that starts the cycle timer.

Located on the index spindle assembly is the pilot gear which meshes with the work. The index spindle gear assembly is designed to allow a 0.010-in. yield to compensate automatically for gears that run out-of-round or are up to 0.020 in. oversize. If it is desired to chamfer a gear more heavily on one side, a radial adjustment on the pilot gear allows this condition to be set.

Depth of cutting stroke for maximum efficiency is infinitely adjustable between limits by swinging the adjustment arm located on the side of the outer cam-follower arm. The cutting-stroke cam is located on the same side of the machine and is readily accessible from the side of the head casting in case a change is necessary. Cams furnished with the machine cover a variety of all gears. Examples of conditions necessitating

Materials and Parts

a change in cams include changing from a right-hand to a left-hand helix gear or chamfering a spur gear where hub interference does not permit a normal cutting stroke.

Operator safety has been made a feature of the machine which is fully enclosed. A safety cover, part of the tooling for the particular gear being chamfered, eliminates possibility of injury during loading or unloading. Two socket-head screws hold cover in place.

All parts such as shafts and pulleys are mounted in lifetime-lubricated anti-friction bearings. Index worm and gear run in a continuous bath of oil in a sealed housing. The only pressure-lubricating fitting is on the cam follower.

An electrical control panel at the side of the machine contains the reversing control and the timing adjustment. Flipping the selector switch reverses the direction of rotation of the index gear. Timing cycle for a particular gear is adjusted by a single screw located just above the reversing switch.

The Burr-Master line has been developed for maximum production with minimum downtime. In addition, the full length of the form tool is ground and only the face will require sharpening. When resetting the tool, the face butts against a stop-block.

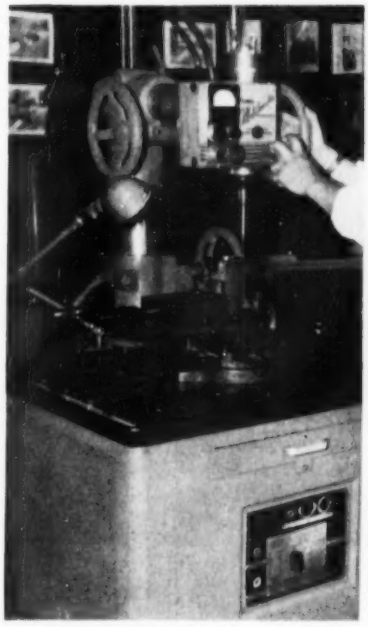
Two basic models handle gears with pitch diameters from $\frac{5}{8}$ to $6\frac{1}{2}$ in. and from 3 to $9\frac{1}{2}$ in. Each capacity machine is also available as a two-station model. In addition, machines can be supplied with position clutch to stop tool while "out." This is necessary when chamfering a gear in an undercut.

Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 4, Mich

Drying Unit

Merco heating and drying equipment consists of infra-red pyrex tubes requiring only two connections. Tube resists thermal and mechanical shock and gives no hot spots. Operating cost is said to be lowered because power consumed is transformed into heat rather than light. Available in lengths of 2 to 8 ft, widths, 12 to 30 in., guaranteed for one year.

Corona Manufacturing Corp, 5210 San Fernando Rd, Glendale 3, Calif



Metalmaster Disintegrator Available in Three Models

Metalmaster Disintegrator (*AM* — Aug 25 '49, p136), with redesigned cutting head, is available in hand model (for use on standard drill-press) and medium model as well as large machine illustrated.

Large machine, model 952, removes broken taps with sizes ranging from No. 0 to $\frac{3}{4}$ in. Machine can also be used for producing holes of any shape (by forming an electrode) in soft or hard metals, including carbides. Accuracy depends on electrode and setting, but it is claimed that unit should produce holes on some electrodes with as little as 0.002 in. overburn.

Superstructure (to bring electrode into position) includes head housing permitting 360° swing in vertical plane and cross arm housing permitting 360° swing in horizontal plane. Table is surface ground and holds 1500 lb.

Control panel contains ammeter, head switch, start-pump button, stop button, and pilot light. Speed selector has twelve settings. The head vibrates the electrode, cycling 3600 times a minute.

Metalmaster Div, Clinton Machine Co, Clinton, Mich

... INCLUDING

Optical gaging of cam contours enables inexperienced operator to check entire contour in 40 seconds ... page 140

Hole-piercing and notching units mount on lower press bed to eliminate customary die sets ... page 140

Automatic diamond turner, electro-mechanical, indexes diamonds by positive, precise increments ... page 141

Expanded line of hydraulically and electrically controlled surface grinders includes sizes from 10 to 18 in. ... page 141

Key-reel with clock spring mechanism keeps chuck key readily available ... page 142

Diemaking machine combines operations of steel rule bending, cutting, notching, and vertical circular rule cutting ... page 148

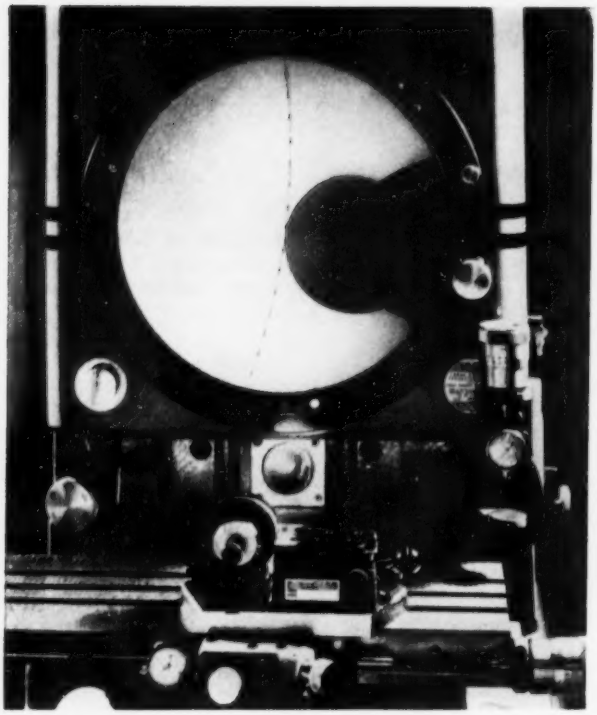
Bench comparator covers variety of gaging by using convertible column and indicator ... page 150

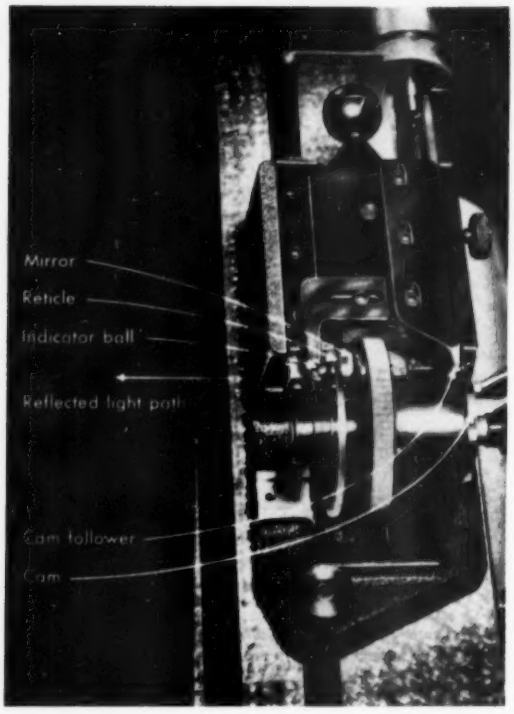
Hydraulic lift truck has 2-in. fork-width adjustment and five interchangeable lengths ... page 152

... and in Sept 14

Power tube flarer handles tubes with OD from $\frac{1}{8}$ to 2 in. and, with interchangeable heads and attachments, burrs and chamfers tubes in same range.

Hydraulic flanging press has two 300-ton cylinders acting independently or simultaneously.





Entire Cam Contour Checked in 40 Seconds

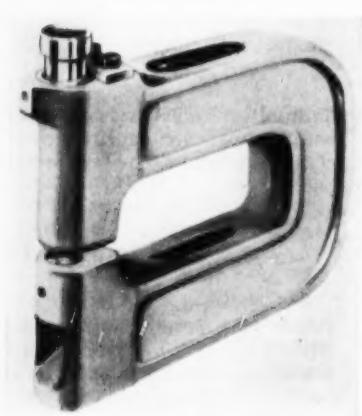
Optical Gaging Products has developed a staging fixture for use in conjunction with the Kodak contour projector for the optical gaging of cam contours (*AM*—Jan 5 '53). An infinite number of points can be checked and, with tolerances as close as 0.0005 in., an inexperienced operator can reportedly check the entire contour of a cam in 40 sec.

The cam is mounted on an arbor of the staging fixture. An adjustable yoke carries a precision hardened steel ball spring-loaded to follow the contour of the cam. On the other leg of the yoke a flattened circular indicator duplicates the follower motion and has its image projected on the screen. Also on this side is the reticle which rotates with the cam and is a precise actual-size reproduction on glass of the contour and tolerance lines as specified on the cam drawing. Thus both contour and tolerance lines may be viewed on the screen as cam is rotated by turning arbor by hand.

Light source is the surface illuminator of the projector. The light rays issue from the projector toward the fixture and are reflected back through the reticle and across the indicator. The image can be projected on the screen at any selected magnification.

A reference point for starting is determined by using a setmaster providing a V-notch for positive location of the follower at the initial reference point specified on the drawing. Adjustment is made until the image of the indicator ball is tangent to the image of a set-line. The setup can be securely locked in position after which the master-set cam is replaced by the cam to be checked.

Optical Gaging Products, Inc, 26 Forbes St, Rochester 11, NY



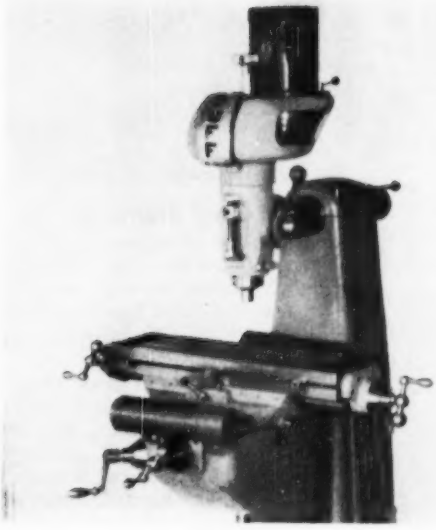
Hole-Punching Units Mount on Lower Press Bed

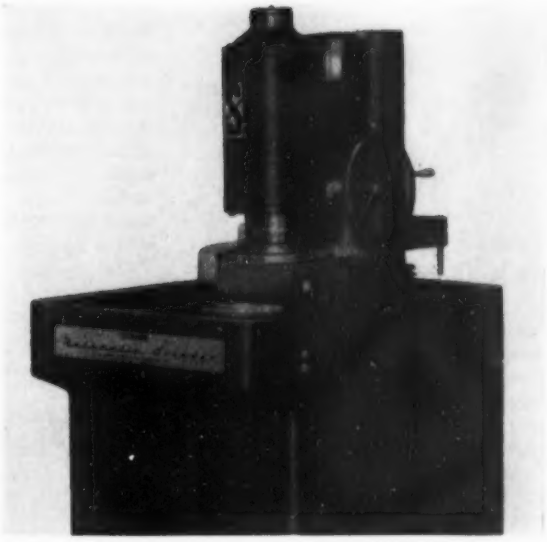
Toolset line of hole-piercing and notching units can be mounted on lower bed of press to eliminate customary die sets. Press furnishes the force to drive punch through the work. Free-floating punch and guide transmit the load of stripping directly to the work instead of the upper arm of the holder. Punch and die are permanently and automatically aligned in the holder.

Toolsets can be set up in any desired pattern by bolting the holder in position on a mounting templet, or by locating in a T-slotted plate. Units can be reused in any number of setups.

Stock sizes include widths of 1, 1¼, 1½, 2¼, 2¾, and 3½ in. with from 4- to 16-in. throat depth. Each holder will accommodate punches for round, square, rectangular, or special shapes.

Toolset, Div of General Riveters, Inc, Buffalo, NY





Duff Redesigns Vertical Miller

Redesign of Duff vertical miller features speed range of 300 to 3200 rpm and ½-in. collet capacity. Table size is 8x24 in. and maximum distance of spindle to table is 15 in. Longitudinal feed is 15 in., vertical feed of knee 14 in., and crossfeed 8 in. Quill travel is 3 in. Spindle is driven by ¾-hp motor. Weight of the machine is approximately 1200 lb.

Duff Machine & Die Co, 31 Wingate St, Haverhill, Mass

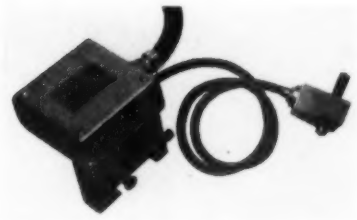
Expanded Line of Rotamatic Grinders Includes Sizes from 10 to 18 in.

Expanded line of Rotamatic surface grinders includes 10-, 12-, 14-, 16-, and 18-in. sizes. Machines are hydraulically and electrically controlled for complete grinding cycle.

Equipment includes 7½- or 10-hp precision motorized grinding spindle with heavy-end-thrust construction. Units are arranged for type 2 steel-back grinding wheel or segmented-wheel chuck. Graduated handwheel provides independent vertical adjustment. Grinding head is actuated on hydraulic column.

Rotamatic is available with such equipment as high-speed precision internal-grinding spindle, grinder head and feed having graduated swivel mounting, ASSN spindle nose, and rotary table or work holders.

Standard Electrical Tool Co, 2480 W Sixth St, Cincinnati 4, Ohio



Automatic Diamond Turner Positively Indexes Diamond

Industrial diamond turner is a self-contained electro-mechanical device designed to automatically index the dressing diamond by positive, precise increments. Unit will rigidly support a standard shank diamond tool and provides ranges of indexing to meet all grinding requirements in odd increments of rotation so that the pattern of flats worn on the diamond will never repeat.

The diamond turner is compact and fits into the existing diamond holder of the machine; it is electrically operated and can be actuated by mechanical contact, or manually. Control box is wired to 115-v ac outlet and secured so that actuator plunger can be tripped by movement of dresser slide.

Seals are provided for the rotating diamond chuck as well as for the housing and electrical outlets.

The Industrial Diamond Co, 2392 Wolcott, Ferndale 20, Mich

Chrome Plating Concentrate

Ward Leonard has developed Chromasol No. 2 for use with Chromaster industrial chrome plating units. Solution is reported to have deposit hardness characteristics comparable to any conventional chrome plate above the file hard range. Solution can be applied to most metals in deposit thickness of 0.015 in. or more. Preparation involves adding three parts water to one part Chromasol concentrate. Rate of deposit is 0.002 in. per hr.

Ward Leonard Electric Co, Mt Vernon, NY

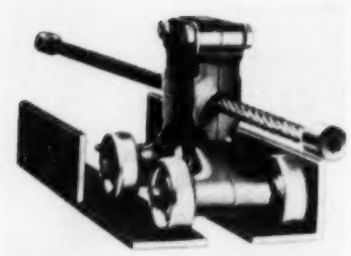
Portable Belt Grinder Also Mounts Rigidly

Adapt-a-belt is made for use as a portable grinder attached to an air outlet or a rigidly mounted unit clamped to a lathe, milling machine, drillpress or pedestal grinder.

Unit uses dynamically balanced, rubber-covered contact wheels in various diameters, widths, and degrees of hardness. Construction is of light-weight steel. Belt tracking mechanism is said to provide efficient belt tensioning.

Model A-1 uses belts to 1-in. width; A-2 to 2-in. width.

Curtis Machine Corp, Jamestown, NY



Power-Driven Cable Conveyor Designed for Table Height

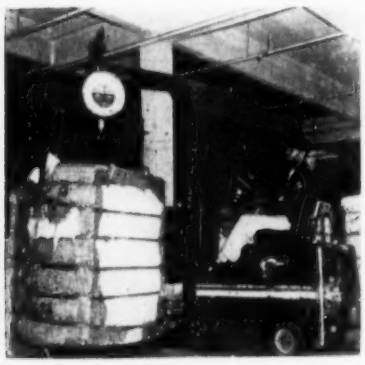
Conveyor has 4-wheel carriers attached to a ⅜-in. steel cable (7x19 aircraft) and pallets, shelved trays, fixtures, and other devices can be attached to conveyor trolleys. Conveyor can be inclined to higher elevations and floor- or ceiling-mounted.

Trolleys are positioned permanently by Bush-Lock bushings swaged onto the cable under high pressure. Bushing locks to cable with strength equal to cable itself (14,400 lb).

Cable splicing is said to be easy. Splice and intermediate two-piece trolleys which bolt over Bush-Lock fitting are identical.

Trolleys run in formed steel channel track and can turn horizontal corners around sheaves of 15-, 19-, 26⅝-, 30½-, or 38⅛-in. pitch dia.

E W Buschman Co, 4401 Clifton Ave, Cincinnati 32, Ohio



Lift Truck Attachment Weighs Merchandise

Dillon electric or hydraulic lift truck attachment is a combination swivel arm and scale that weighs merchandise while it is being transferred.

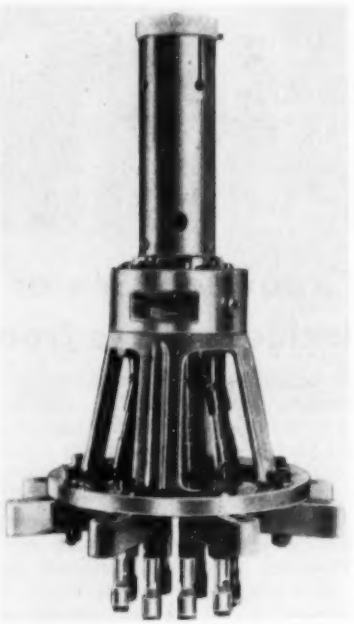
Steel arm, welded to front of truck, revolves in wide arc and can be locked as desired; on end of arm a hook is provided to engage weight indicator. Scale can be removed and used at other points in shop. Dial dia is 16 in.

W C Dillon & Co, Inc, Box 3008, 14620 Keswick St, Van Nuys, Calif

Folding Table and Bench Unit Locks Into Steel Truck

Mobil-Fold unit consists of two 14-ft tables and four 14-ft benches which fold and lock into all-steel, caster-equipped truck. Parts have welded tubular steel understructures with ¾-in Philippine mahogany plywood tops with high-pressure, laminated, heat-resistant plastic surfaces and backer sheets, and full-length formed steel reinforcements.

Schieber Sales Co, Detroit 23, Mich



Multiple-Drill Tapping Head Has Built-in Reverse

Universal-joint adjustable auto reverse tapping head, for mass production work, has the reverse built into the head. Device is only an inch longer than the standard universal-joint drilling head, used for mutiple drilling of any pattern of holes.

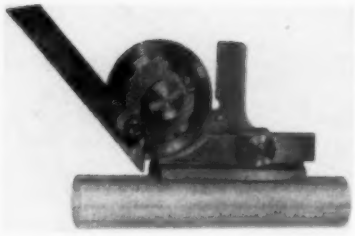
Heads are designed to tap two, three, or four holes from 11/16-in. centers to within 5¼-in.-dia circle for tapping 0 to ¼ in.

Errington Mechanical Laboratory, Inc, Staten Island 4, NY

Key-Reel Holds Chuck Key

Device for anchoring chuck key, called Key-Bak, is a key-reel with Swedish clock spring mechanism, 24-in.-long steel chain, polished chrome case. Chuck-key is attached to special sling on Model No. 7 unit for drillpresses; other models available to hold welder's lighters, keys, and similar items. Price, $2.50.

Lummis Manufacturing Co, 2242 E Foothill Blvd, Pasadena 8, Calif



Universal Bevel Protractor

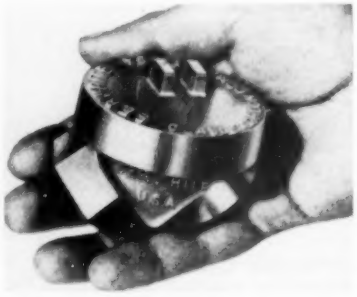
Stainless steel universal bevel protractor with vernier, features acute angle attachment for fast setting of fine acute angles and detachable base which keeps tool in upright position.

Unit gives readings to nearest 5 minutes from graduation lines recessed to eliminate wear. Mercury eccentric clamping and releasing mechanism holds blades independently of firm-holding thumbnut, allowing blades to slide along their full length. There are no projections on backside to hinder paper layout work.

Acute angle attachment connects to base line of protractor from which all graduations are taken, thus eliminating all accumulated errors. Eccentric clamping and releasing mechanism allows free sliding of attachment and fast setting.

Design of base permits measurement around shaft. Base is ground on all surfaces. Device comes packed with one 6-in. and one 12-in. blade.

Mercury Supply Co, 419 Fairview, Elmhurst, Ill



Thermocouple Head Withstands 900 F

Serv-Rite thermocouple head was reportedly designed for compactness. Base and cap are constructed of malleable iron. Friction-lock cap can be removed by a quarter turn. Within cap is asbestos gasket to assure head is dirt- and moisture-tight. Connector block will withstand 900 F in continuous service. Protecting tube opening is ½, ¾, or 1 in.

Claud S Gordon Co, 3000 S Wallace St, Chicago 16, Ill

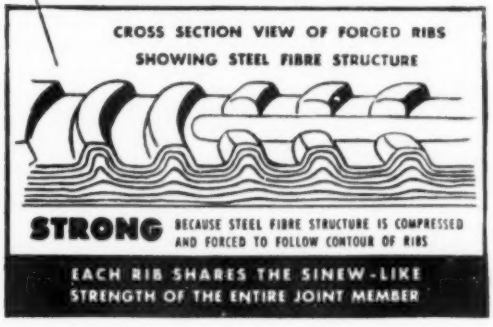
UTICA'S NEW RIB-JOINT®

Pliers # 507-10

With *FORGED* rib-joint for added strength exactly where you need it.

FULL FORGED RIBS CAN *TAKE* IT!

AND HERE'S WHY:


CROSS SECTION VIEW OF FORGED RIBS
SHOWING STEEL FIBRE STRUCTURE
STRONG BECAUSE STEEL FIBRE STRUCTURE IS COMPRESSED AND FORCED TO FOLLOW CONTOUR OF RIBS
EACH RIB SHARES THE SINEW-LIKE STRENGTH OF THE ENTIRE JOINT MEMBER

Full forging of the rib joint is the secret of this new UTICA pliers. Forging makes the steel fibre structure follow the contours of the ribs as shown in the diagram above. Hence, each rib shares the sinew-like strength of the entire joint. There is no weak point, likely to break, with this method of manufacture.

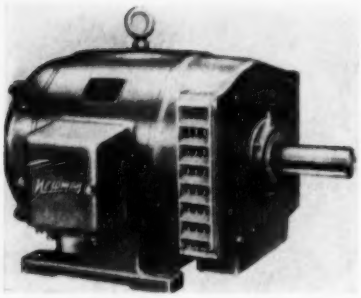
Be sure you see these new pliers! One look, one "heft", and you'll know that they live up to the standard of UTICA® quality.

It pays to use quality tools — U TI CA® — and the world's best tools are made in U.S.A.

DROP FORGE AND TOOL CORPORATION

UTICA 4, NEW YORK

In Canada: ADLAM TOOL & SUPPLY CO., LTD MONTREAL



Line of British Newman Motors Now Available in the US

Complete line of British manufactured Newman integral horsepower motors is available in this country. Range includes totally enclosed, fan-cooled squirrel cage motors, and the open drip-proof enclosures in both squirrel cage and wound rotor electrical types, all built to NEMA standards.

Both designs have primary winding for all standard voltages, consisting of high-conductivity, heat-resistant, synthetic enamelled wire. Completed winding is impregnated with thermosetting varnish, and baked to produce a mechanically strong, damp-proof, oil-resistant finish.

Conduit box is fitted on the left-hand side of the motor on the drive end. Standard size detachable conduit adapter is used. Leads from the stator winding are brought out through an insulated plate clearly marked for lead identification; diagram of connections is included on the nameplate attached to the machine.

Standard-size bearings are fitted to both open drip-proof wound rotor and squirrel cage motors. Roller bearing is used at the drive end and a ball bearing at non-drive end, both of sufficient size to provide a wide safety margin; outer races of both are clamped by spigotted bearing caps. Large grease spaces are provided and easily accessible grease-gun lubricators are fitted. On larger sizes the ball bearing is retained in position on the shaft by a special bearing nut; on smaller sizes by a circlip.

Standard motors are not fitted with short-circuiting gear; it can be supplied when required on Frames 32, 38, and 44. To prevent incorrect starting sequence, a normally open interlock switch is operated by the short-circuiting mechanism.

Motors are available in a range of sizes up to 230 hp.

Newman Industries (America) Inc, 43 Broad St, New York 4, NY

CURTA CALCULATOR (AM—June 9 '52, p198) has been redesigned to handle problems of 11x8x15 digits. Model II still fits the hand and now weighs 12 oz — *Imported by Curta Calculator Co, 3851 W Madison St, Chicago 24, Ill*

Gas-Fired Line Burner For Wide-Area Heating

Eclipse gas-fired, retention-type line burner is said to be excellent for oven- and air-heating installations, including air systems for spray booths. Units are of blast-burner design and may be installed to fire in any direction. Each section is equipped with drilled and matched flanges; adapter flange is available for applying either blast or atmospheric pilot and flame failure protective equipment.

Eclipse Fuel Engineering Co, Rockford, Ill

Strippable Coating Protects Aluminum, Glass, Phenolics

Fast-drying strippable coating, CD Strip 100, is supplied as solvent solution and applied by dipping, brushing, or spraying. Water-insoluble coating, bright red in color, peels back in one piece.

Product can also be used in place of masking tape. Because it is liquid it can be applied as smooth coating over any irregular surface. Another possible use is the interior walls of spray booths.

Chemical Development Corp, Danvers, Mass

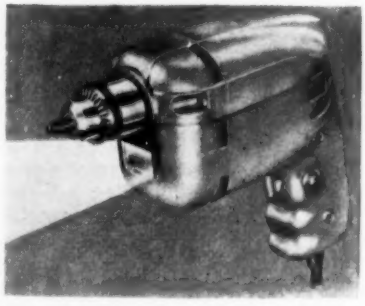
Portable Electric Marker Can Vary Stroke Intensity

Portable electric marker in standard and heavy-duty sizes has been introduced for freehand marking on all steel (before or after hardening), on alloy steels and ferrous alloys, as well as cast and wrought iron.

Ten-station rotary switch and regulating knob enable operator to make a light or bold mark by simple adjustment of dial; because of control factor, device is particularly useful for gage blocks, highly finished precision dies, and parts liable to be damaged by other marking methods.

Electro-Marker standard model EM-60 for use with 115 or 230 v ac, 50 to 60 cycle, is a 500-w unit; EM-120, the heavy-duty model, is 1000 w. Overall size is 8¼ in. wide, 10 in. high, 5 in. deep, and 6¼ in. deep for the two models respectively. Weights are 20 and 30 lb.

H P Preis Engraving Machine Co, Hillside, NJ



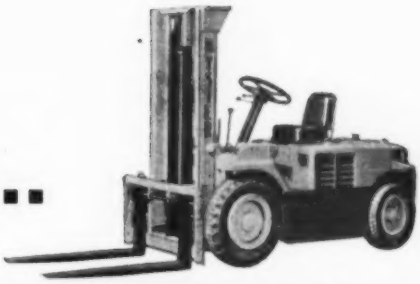
Portable Electric Drill Features Built-in Light

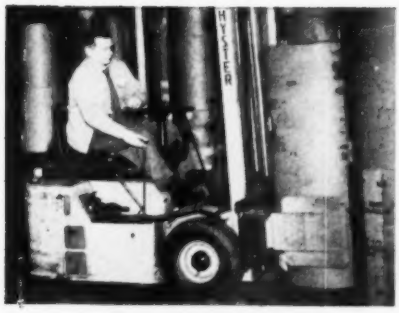
Work-Lite, ¼-in. standard duty portable electric drill, weighs only three pounds. Unit is equipped with Jacobs geared chuck, Cutler-Hammer trigger lock-type switch, aluminum die-cast housing, ball thrust and armature spindle ball bearings; no-load speed is 2100 rpm and full-load speed is 1000 rpm.

Price of unit is $27.95.

Fairchild Industries, Div of Fairchild Camera & Instrument Corp, Burlington, Vt

To all basic HYSTER TRUCKS...



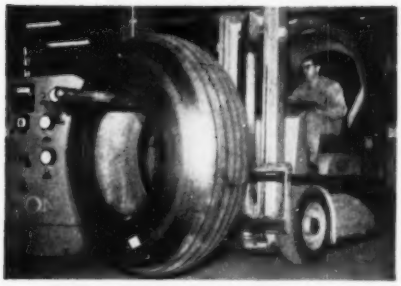


Paper-roll Load-Grab

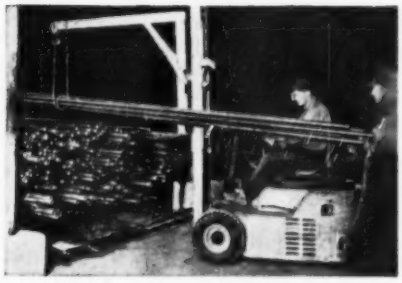
Karry Krane with Boom Extension

4-Barrel Load-Grab

Scoop—for loose aggregates.



Ram—for tires, rolls, spools, etc.



Boom—for odd shapes, light crane work.

you can add... HYSTER attachments

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Are your materials hard-to-handle? The right Hyster® Truck Attachment — and Hyster offers more than 100 of them — frequently is the *key* to greater profits.

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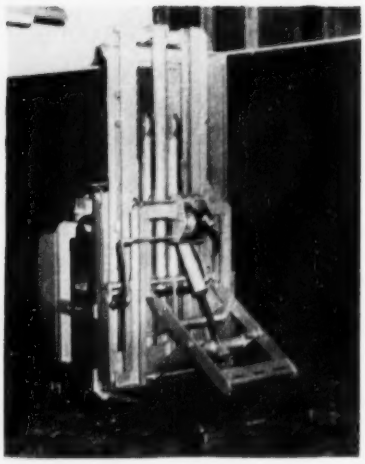


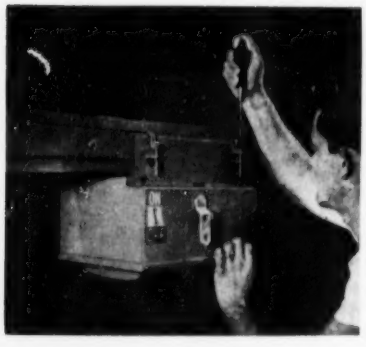
Raymond Electric Truck Handles 1-ton Dies

Truck is equipped with hydraulic push-pull device for die placement or removal at storage racks or flat bed presses. Chain attached to both die and hydraulic device is used to load die on truck.

Truck is also equipped with angle winch to facilitate loading at an inclined press.

Right-angle stacking can be done in 6 1/3-ft aisle and forks can be lengthened from 9¼ to 30¼ in.

The Raymond Corp, Greene, NY



Electric Power Switch Installed in Three Minutes

FG Flex-A-Plug taps power from FVK Busway and can reportedly be installed in three minutes because of hanger clips which hold the plug in position while screws are tightened.

Unit reportedly has the ability to resist heavy current surges without damage. Heavy-gage-steel side shields, as well as phenolic shields, protect the stabs. Device is available with 30-, 60-, 100-, and 200-amp ratings.

Trumbull Electric, Dept of General Electric Co, Plainville, Conn

Oil-Circuit Recloser

Type FR oil-circuit recloser with one-way seal for moisture protection is available with a time-current characteristic to allow interchangeability with other makes. Seal, positioned around operating handle shaft, permits release of internal pressure, and prevents moisture-laden air from entering. Current ratings added in the new line are 70, 100, and 140 amp.

General Electric Co, Switchgear Dept, Schenectady, NY

Ratchet Action Stud Wrenches

Stud wrenches are said to combine large capacity, speed, and positive operation with economy. Ratchet action is built in. Tool comes in two sizes to handle any OD from ¼ to ¾ in., regardless of contour. SW-1 ($7.50) with capacity through ½ in., takes either internal ½-in.-square or external 1-in.-hex drive. SW-2 ($12.50) takes 1¼-in. external hex drive and is hollow to accommodate any length stud. Its capacity is 17/32 to ¾ in. inclusive. Overall dia of SW-1 is 2 in., permitting removal of studs only 1 in. apart because action is not eccentric. SW-2 is ½ in. larger.

Milled jaw teeth of special steel are said to bite with progressive power for either right or left turns. Stud will reportedly either twist off or turn before jaws slip, and tool marks are minimized.

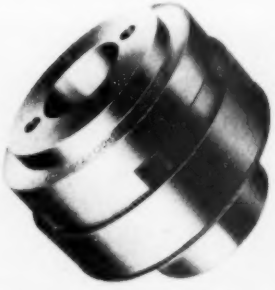
Clark-Feather Mfg Co, Fort Morgan, Colo

Portable Industrial X-Ray Unit For Rapid Weld Inspections

Norelco portable x-ray unit, MG 160 fits into automobile trunk and is designed for rapid inspection of welds, pipe lines, powerplant, ship, and aircraft equipment. X-ray tube head also contains 150,000-v generator and weighs 143 lb. Control unit weighs 80 lb.

Tube is fan-cooled and has end port for handling close work. Power supply is either 115-v or 230-v ac. Arrangement of tube and generator in one housing eliminates need for high-tension cables.

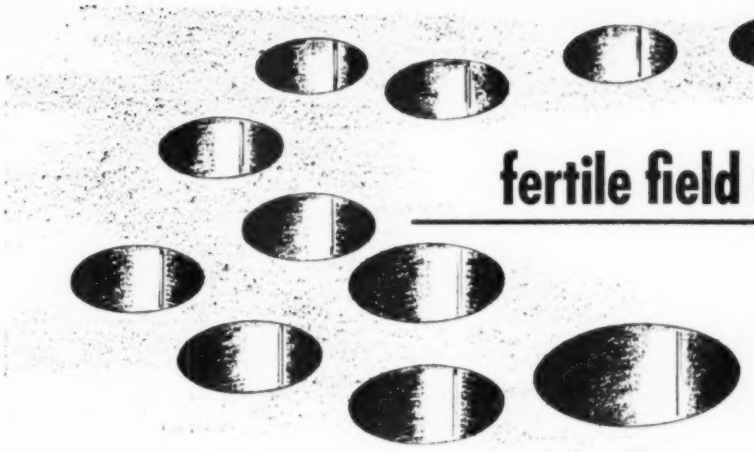
X-Ray Dept, Non-Destructive Testing Div, North American Philips Co, Inc, 750 S Fulton Ave, Mt Vernon, NY



Lovejoy Flexible Couplings

Standard Lovejoy type C flexible coupling has been redesigned and is now described as crawling into the flywheel. One hub has been cut off and, with three or more holes tapped into the remaining flange, the coupling is fastened to the center of the flywheel. Modified coupling not only saves space normally taken up by the hub, but results in cost saving by elimination of the flange. In all other respects, including collar, load cushions, and inside sleeve, it is identical with regular type C coupling.

Lovejoy Flexible Coupling Co, 5078 W Lake St, Chicago 44, Ill

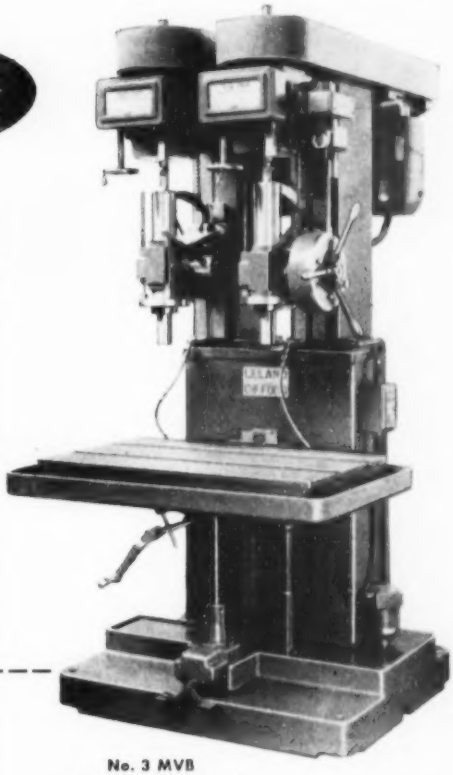


fertile field for cost cutting....

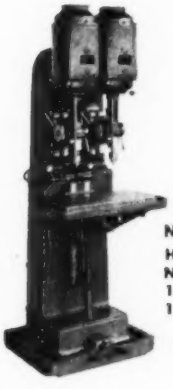
Think of all the HOLES you drill per year

If you want to save money, start where the chances are best . . . *with your drilling operations!* Even a slight reduction per hole adds up fast when you think of the holes you drill per year. But these new Leland-Gifford drilling machines will give you much more than a "slight" reduction. They're miles ahead of anything built twenty, ten or even five years ago.

Fast, powerful, rugged yet sensitive, each is capable of handling a wide range of work. All have new features that make for easier operation, faster work handling, greater accuracy and quicker adaptability to changing production requirements.



No. 3 MVB
Holes from ¼" to 1½"
24" Swing 1 to 4 Spindles



No. 1 LMS
Holes from
No. 80 to 5/16"
12" or 20" Swing
1 to 6 Spindles

No. 2 LMS
Holes from 1/16" to ⅜" 20"
or 26" Swing 1 to 6 Spindles

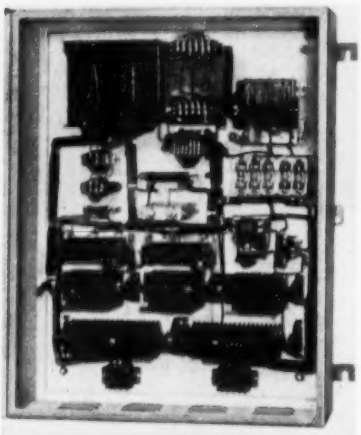
If you drill precision holes, you can't make a more profitable investment than new Leland-Gifford Drilling Machines. Write for complete information.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

Roller Bearing Slide Racks For Heavy Bins and Boxes

Stackbin has added roller bearing slides to its Stackracks to allow heavy bins to slide easily. Like all Stackracks, the new slide racks lock together, without tools, to form storage units of any size, shape, or capacity. Half-way stops are provided for safety.

Stackbin Corp, 1139 Main St, Pawtucket, RI



Magnetic Amplifier Speed Drive Operates Without Vacuum Tubes

Motor speed control, called the Franklin Drive, contains no tubes of any kind, uses only magnetic amplifiers and selenium rectifiers.

Unit is easily mounted and installed. When exact speed desired is set, it remains nearly constant as load on the motor changes; even at 50 rpm, speed does not drop off when load is applied, but holds practically constant to loads of twice the rated motor torque.

Static amplifiers and rectifiers are said to have an indefinitely long life. Drive operates with supply voltages ranging from 200 to 250 v. Additional advantages include instant starting, high overload capacity, and operation over a wide ambient temperature range. Standard size motor is the only item mounted on the driven machine; control enclosure can be mounted in any out-of-the-way location, and operator control station, with start-stop buttons and speed control knob, can be located in any convenient position.

Model E-1 includes standard 230-v dc motor with speed range from 49 to 2450 rpm, and is rated at ¾ hp at maximum speed.

Franklin Control Corp, 1975 S Allis St, Milwaukee 7, Wis

Instrument Continuously Measures Specific Gravity

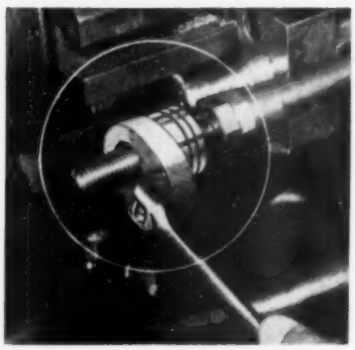
Ohmart Corp series SG specific gravity meter uses radioactivity to measure specific gravity of liquids, slurries, sludges, or granular materials flowing through process pipes or pipelines. Measurements are made at operating temperatures and pressures, generally with no direct contact with process materials and no interference with process procedure.

Instruments incorporate Ohmart cells, Ohmart null system of measurement, and Ohmart indicating dc amplifier. Variation in specific gravity of a flowing material is made over a range of zero to 0.500 above any minimum value, with accuracy of ±0.005 in any range.

Models are available in eight standard ranges from 0.500 to 2.750. Standard measuring unit fits pipes from 3 to 6 in., mounting externally on brackets. Non-microphonic cable connects measuring cell to amplifier, which may be up to 200 ft away.

All components are of dust- and weather-proof construction, protected with acid-proof paint. No high-voltage power supply is needed for operation of instrument, nor are any air or liquid purges or special piping required. Measurements may be transferred to any standard single-record potentiometer recorder having a range of 0-20 mv full scale.

The Ohmart Corp, 2347 Ferguson Rd, Cincinnati 38, Ohio



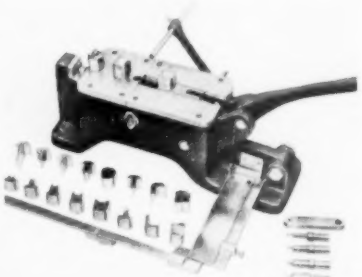
Ratchet Wrench For Use Around High-Standing Center Obstacles

Life Saver ratcheting socket wrench drops down over any length stud and eliminates the need for deep sockets, extensions, and adapters in wrenching around high-standing center obstacles. Wrench has ability to ratchet in a 7° arc.

Equipped for square drive handle, the head will take a regular torque handle. It is claimed that the all-internal ratcheting mechanism will withstand high torquing loads.

Four sets with snap-in sockets accommodate hex nut sizes from 0.375 to 2.125 in.

Tubing Appliance Co, 10321 Anza Ave, Los Angeles 45, Calif



Cramaco Diemaking Machine Combines Four Operations

Machine combines operations of steel rule bending, cutting, and notching and vertical circular rule cutting. Features include eight sets of hard steel bending tools, four sets of mandrels, stroke stop for bending large curves; blade of hardened tool steel with 1½-in. cutting edge, table 8 in. long and 2 in. wide (collapsible table extension takes up to 25-in. cuts of rule) finely graduated measuring scale.

Machine cuts standard size notches ¼x⅝-in.; vertical cutter will cut inside a 1½-in. circle.

Craftsmen Machinery Co, 575-577 Atlantic Ave, Boston, Mass

NOW

MEET THE CHALLENGE OF THE FUTURE *WITH* SIDNEY HEAVY-DUTY LATHES

Preparedness and foresight are far more important in the industrial picture than ever before. The gruelling, punishing production loads on machine tools must take their toll.

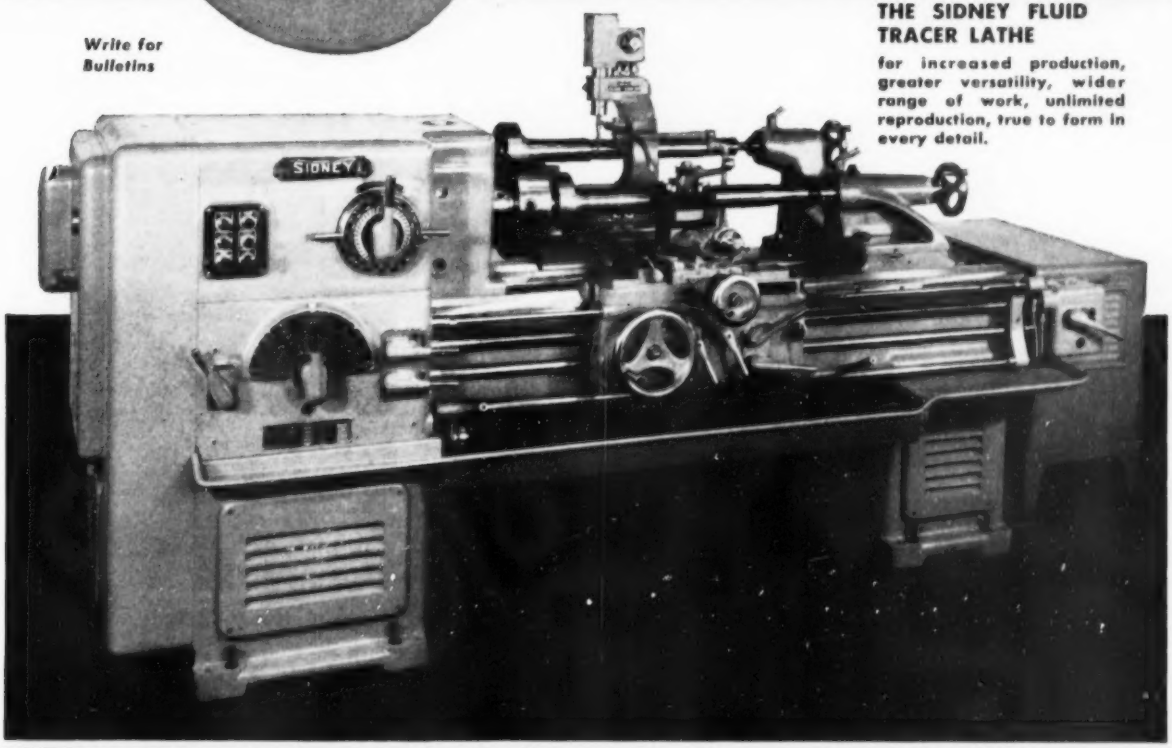
NOW . . plan to replace obsolete equipment with **SIDNEY HEAVY-DUTY LATHES**

NOW . . learn the economies in costs of production

Write for Bulletins

THE SIDNEY FLUID TRACER LATHE

for increased production, greater versatility, wider range of work, unlimited reproduction, true to form in every detail.



THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

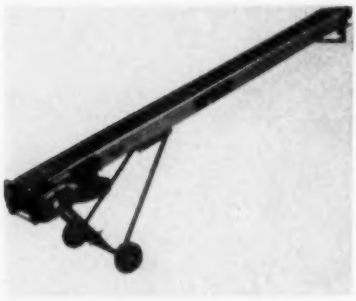
Vard Ball Screwjack Utilizes Freely Circulating Ball Bearings

Utilizing physical principles of screw expansion and the near-frictionless spacer ball, coupled with tolerances of 0.0004 in. in the ball bearing races, Vard ball screwjacks are said to maintain a constant ratio of characteristics with higher average efficiency.

Screwjacks are made up with mating nut and screw, each having helical ball races, precision ground to accurate tolerances. Ball circuit is closed with return tube attached to the nut, allowing ball bearings to circulate freely.

Standard sizes from ⅜- to 4-in. dia and up to 22 ft in length are furnished; screwjacks will also be made to specifications.

Vard, Inc, Pasadena, Calif



Rapistan Aluminum Belt Conveyor Redesigned

Increased load capacity, handy belt-pitch adjustment, and price reductions of 7 to 17% are features claimed for the redesigned Rapistan LS aluminum belt conveyor.

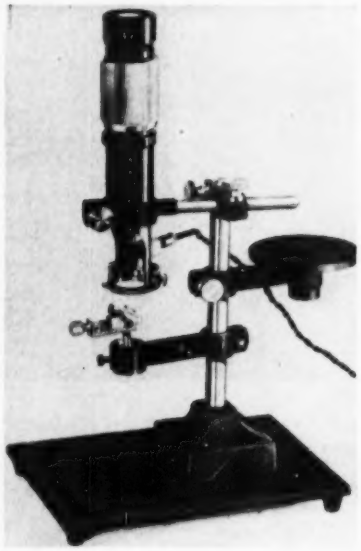
Load rating of some models has been stepped up by using a ½- rather than 1/3-hp electric motor to power the belt. A ¾-hp motor is also available.

Conveyor is made in 10- and 16-in. widths and five lengths from 11 to 21 feet. Each model is balanced on free-rolling running gear.

Built-in jackscrew raises and lowers drive end of unit. This permits fast adjustment to belt pitch wanted after head end of conveyor has been placed in position.

Lightweight conveyor (one model weighs 280 lb) is mounted on either two cushion-rubber demountable-tire wheels, two pneumatic-tire wheels, or a dolly equipped with three swivel casters.

The Rapids-Standard Co, Inc, Dept LSJ, 342 Rapistan Bldg, Grand Rapids 2, Mich



Measuring Microscope

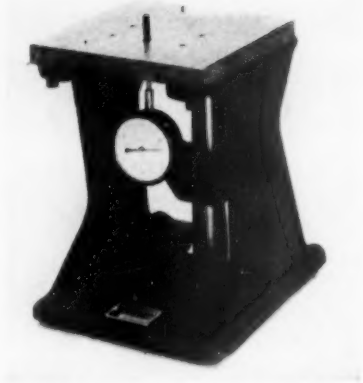
Optometer Model GR measuring microscope is available in two magnifications. The 20-power unit has a field of view of 0.580 in. and a measuring scale reading directly to 0.002 in. The 40-power instrument has a view field of 0.290 in. and reads to 0.001 in.

Model is equipped with a swivel-mounted, work-holding vise, rotating table, built-in illuminator for examination by transmitted or reflected light, detachable base plate, fine focusing adjustment, reticle focusing, and precision achromatic lenses fully corrected for color and spherical aberration.

National Instrument Co, 5005 Queensbury Ave, Baltimore 15, Md

Ray-O-Vac No. 3LP industrial battery is fully sealed in steel—jacket, top, and bottom, guaranteeing against any corrosion damage. Battery does not weaken with storage, and need not be dated.

Ray-O-Vac Co, 212 E Washington Ave, Madison, Wis



Bench Comparator Covers Variety Of Gaging Requirements

Model TD-5 bench comparator is a general purpose gage designed to measure height, thickness, depth, counterbore depths and diameters, and offsets. These measurements are made possible by the over-and-under convertible feature of the column and indicator position in reference to the platen surface.

Tapped holes are provided in the platen to accommodate gaging fixtures and part-position blocks.

Acra-Ment Gage Division, Meyer Corp, 633 Park Ave, Cranston, RI

Whitney Tool Cuts Rods With ⅛- to ¾-in. Dia

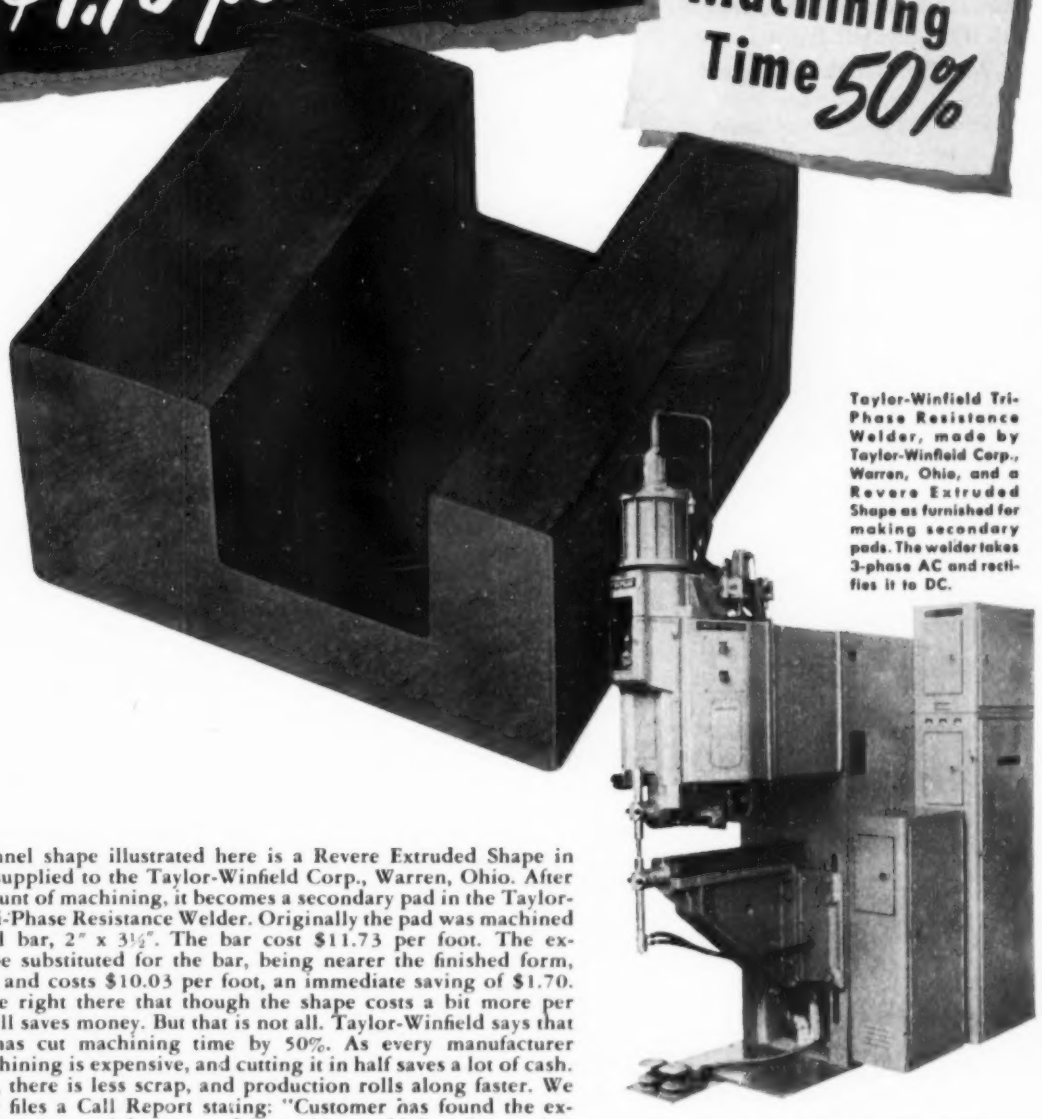
Whitney No. 400 rod cutter consists of movable shear blade and fixed shearing die, both easily replaceable. Blade is moved by geared 48-in. lever. Capacity is mild steel rods with dia from ⅛ to ¾ in.

Weight of tool is 42 lb; price $50.

Whitney Metal Tool Co, Rockford, Ill

REVERE
Extruded Shape SAVES *$1.70 per foot...*

CUTS Machining Time *50%*



Taylor-Winfield Tri-Phase Resistance Welder, made by Taylor-Winfield Corp., Warren, Ohio, and a Revere Extruded Shape as furnished for making secondary pads. The welder takes 3-phase AC and rectifies it to DC.

● The channel shape illustrated here is a Revere Extruded Shape in copper, as supplied to the Taylor-Winfield Corp., Warren, Ohio. After a small amount of machining, it becomes a secondary pad in the Taylor-Winfield Tri-Phase Resistance Welder. Originally the pad was machined out of solid bar, 2" x 3½". The bar cost $11.73 per foot. The extruded shape substituted for the bar, being nearer the finished form, weighs less and costs $10.03 per foot, an immediate saving of $1.70. You can see right there that though the shape costs a bit more per pound, it still saves money. But that is not all. Taylor-Winfield says that the shape has cut machining time by 50%. As every manufacturer knows, machining is expensive, and cutting it in half saves a lot of cash. In addition, there is less scrap, and production rolls along faster. We have in our files a Call Report stating: "Customer has found the extruded section very satisfactory, and bases his machining time-saving on production runs and not estimates."

Credit for this fine achievement has to be shared by a number of people, both in Taylor-Winfield and in Revere. Our Sales and Technical Advisory staffs collaborated closely with the customer's engineering, production and purchasing personnel. Everybody considered all angles, and worked out this money-saving plan.

So we suggest that if you are doing any extensive machining of copper and copper alloys, or aluminum alloys, it would be a good idea to look into Revere Extruded Shapes. They might offer you important economies. We will be glad to consult with you. Just get in touch with the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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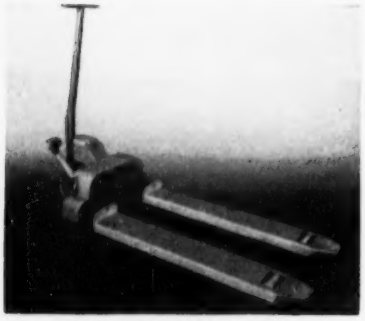
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities, Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS



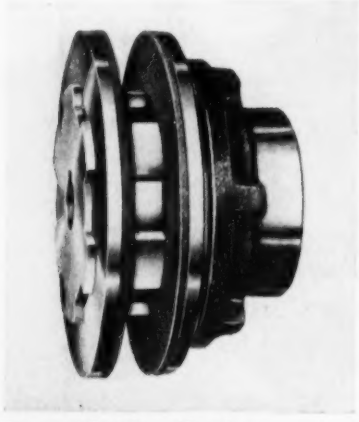
Rack Hydraulic Lift Truck Has 2-in. Fork-Width Adjustment

Turnabout Adjust-A-Fork hydraulic lift truck features interchangeable and adjustable forks. Five standard fork lengths—30, 36, 42, 48, and 60-in.—are available and fork width may be adjusted from 25 to 27 in.

It is stated that new metallurgical developments provide added strength in forks, shafts, on pump pedal, and on other strategic parts where extra strength is necessary.

Truck weighs 299 lb, has 270° steering arc, and has a capacity of 2500 lb. Truck, complete with forks, sells for $350. Truck and forks may be purchased individually.

Rack Hydraulic Equipment Corp, Connellsville, Pa



Torque-Limiting Clutches Provide Overload Protection

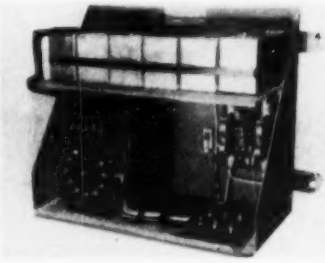
Morse Chain Co adjustable torque-limiting clutches provide overload protection for machine drives in variety of equipment. Slip-type friction clutches act as automatic shear pin mechanisms and are particularly adapted to roller chain drives. Torque-capacity limitation of the drive is 260 ft lb.

Clutches consist of steel body, two steel clutch plates, two friction disks, Belleville clutch spring, and cast-iron adjusting nut. Rotating member is held between friction disks by spring pressure exerted on clutch plates that slide on splines on hub. Torque setting is obtained by adjusting spring tension with thumb-nut.

Units are mounted on driveshafts with standard keyway and setscrew arrangement. They are disassembled by removing the adjusting nut and sliding the spring, clutch plates, friction material, and rotating member over the hub.

Clutches are made in 4½-, 5½-, and 6½-in.-dia sizes with ratings of 55, 121.5, and 260 ft lb. Max bores are 1, 1½, and 2½ in. Overall lengths are 2 9/16, 3, and 3⅞ in. Hub OD's are 2.000, 2.625, and 4.250 in.

Morse Chain Co, 7601 Central Ave, Detroit 10, Mich



Unit Converts Single-Phase Power to Three Phase

Add-a-phase permits the operation of all NEMA Class B, C, variable speed and two-speed motors from a single-phase lighting service. Device will develop 150% starting torque and maintain 110% load without exceeding manufacturer's rating.

Converter is designed in two types: CS for constant speed and 2S for two speed. Either allows operation of three-phase motors in specified class from single phase 220-v line.

Advantages obtained are the lower starting current of three-phase operation and the economy of obviating the need of three phase installation. Add-a-phase draws a leading current from the line and thus improves the system power factor.

System Analyzer Corp, 1327 N Market St, Milwaukee 2, Wis

Metalized pressed steel pots for heat treating furnaces, said to give up to 200% longer life than ordinary containers, have been introduced with three different types of coatings for temperatures up to 1500 F, for 1500 to 1700 F, 1700 F and over. Resistant coatings protect surfaces against heat and oxidation and scaling caused by hot gases.

Eclipse Fuel Engineering Co, 1002 Buchanan St, Rockford, Ill

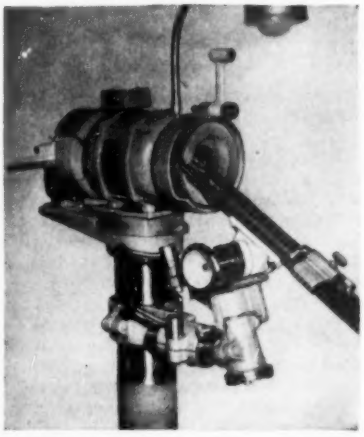
Welder Has Wide Range Of Current Adjustments

Miller moving coil transformer-type industrial welder was designed to meet the need for a compact 50% duty cycle unit with wide range of current adjustments. Designated as model 99, it has a rated output of 250 amp at 30 arc volts with top output of 350 amp.

Two open-circuit voltages, on different ranges, give the machine a wide range of applications; higher open-circuit voltage is used for low-hydrogen electrodes.

Air-spaced primary and secondary coils are wound with double-glass-covered insulated wire; continuous current control uses the moving-coil principle; standard operation is with 220- or 440-v supply.

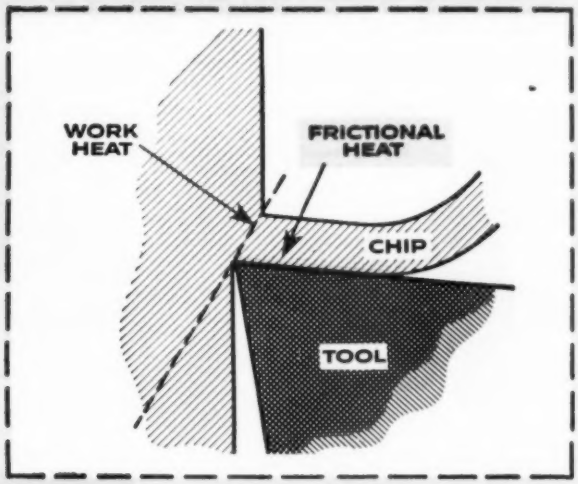
Miller Electric Manufacturing Co, Appleton, Wis



STERLING DRILL AND CARBIDE GRINDER, Model DA, has been redesigned for greater operator convenience. Improvements include substitution of quick-acting levers for two hex nuts requiring wrenches — *McDonough Mfg Co, Eau Claire, Wis*

JOHNSON'S WAX-COOL ATTACKS FRICTIONAL HEAT

New water-soluble coolant effectively lubricates at tool-chip interface.



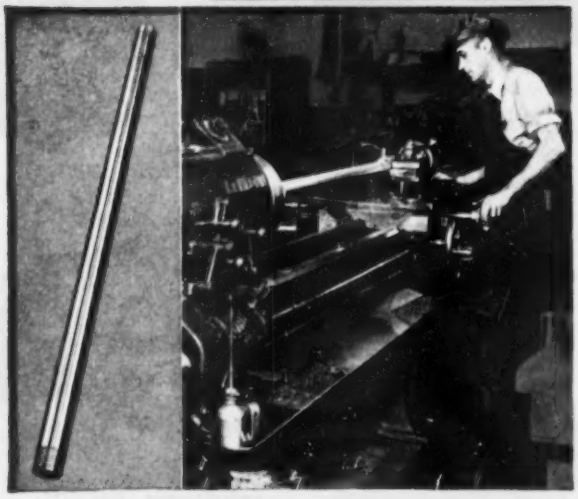
1. WAX-COOL stays with tools and material even at temperatures up to 450°F and pressures up to 200,000 P.S.I.

2. WAX-COOL prevents chip weld because work runs cooler.

3. WAX-COOL effectively minimizes frictional heat which is by far the principal source of heat.

Because of the greater lubricity of certain waxes and their high polar attraction for metal, Wax-Cool is the first coolant to greatly reduce frictional heat at the tool-chip interface. Wax-Cool also has the heat carry-off properties of ordinary coolants—to check work heat generated in the shearing zone.

HERE IS PROOF!



Wax-Cool is being used effectively on this tough job at the E. J. Longyear Company, Minneapolis. They are turning down the external surface of a 4'6" length of #2320 steel tubing. One rough and one finish cut. On a 15-piece run it took 3 days with 4 pieces of scrap, and a poor finish. With Wax-Cool the job was done in 2 days with no scrap and a mirror finish. They used to cut halfway and reverse the tube in the lathe. Now they cut its full length for a straight, accurate cut.

Wax-Cool created these savings

One day saved on a job that used to take 3 days
No scrap
Mirror finish right from the lathe
Tool life doubled
No hot chips to handle

A test is your best proof

See for yourself how Johnson's Wax-Cool can give you economy and performance you never dreamed possible. Real savings in tools and time make Wax-Cool inexpensive to use. Call your local Johnson distributor, or write to:

INDUSTRIAL PRODUCTS DEPT. AM82
S. C. JOHNSON & SON, INC., RACINE, WISCONSIN

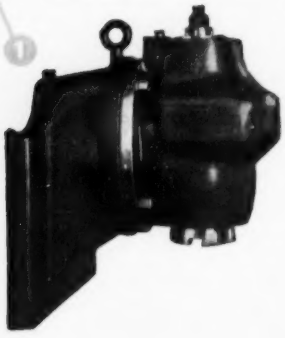
Ask about Wax-Cut—*wax-type cutting oil for automatic screw machines, gear cutting machines, etc.*

Ask about Wax-Draw—*wax lubricant for drawing and forming all types of metals.*

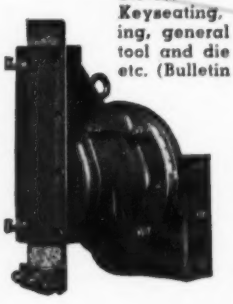
Milling Machine Attachments that STEP UP PRODUCTION

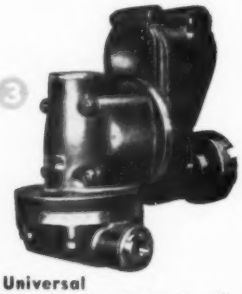
You can easily convert your general duty Milling Machine to a special purpose Miller by utilizing Kempsmith Standard Attachments. They can handle a great variety of milling operations with speed and precision, thereby enabling you to step up your plant production. Attachments 1 to 3, shown below, can be mounted on Kempsmith Millers. Numbers 4 to 7, inclusive, can be mounted on ANY make of milling machine. The same high degree of rigidity and precision characteristic of Kempsmith Milling Machines for more than 60 years is embodied in these sturdy standard attachments. Thousands are serving industry every day, performing the most delicate and accurate operations, or handling difficult production milling jobs. So plan now on broadening the scope of YOUR milling machines by applying Kempsmith Attachments. Write for bulletins.

Vertical Head
Converts horizontal to vertical machine, retaining identical spindle characteristics. (Bulletin No. 105)



Slotter
Keyseating, broaching, general slotting, tool and die making, etc. (Bulletin No. 107)



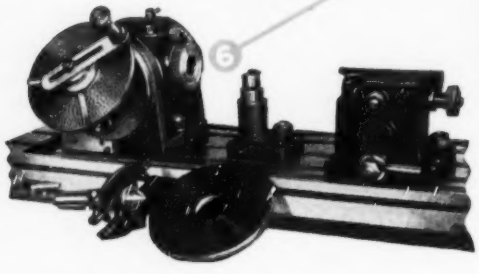


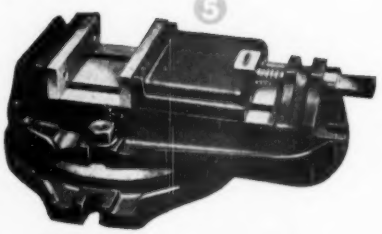
Hi-Speed Universal
High speed angular milling in all planes. (Bulletin No. 113)

Arbors and Accessories
A full range for standardized spindles carried in stock. (Bulletin No. 116)

Circular Table
Milling circles or cams, gear cutting, high-speed continuous milling, etc. (Bulletin No. 106)

Dividing Head
Precision indexing. Spiral cutting mechanism and chuck also available. (Bulletin No. 119)





Vises
Standard and Heavy-Duty, plain and swivel types. Adaptable to special jaws to save fixtures. (Bulletin 117)

THE KEMPSMITH MACHINE CO., MILWAUKEE 14, WISCONSIN, U. S. A.

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Precision Built Machine Tools Since 1888

The KEMPSMITH MACHINE CO.
Milwaukee 14, Wis., U.S.A.

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Hobbs engine hour meter can now be furnished to users of all Towmotor lift trucks; available as original equipment at additional cost, or installed on units already in use. Instrument permits recording of all phases of operations, eliminates guesswork in scheduling maintenance functions and service checkups. Meter operates only while ignition switch is turned on; after recording 10,000 hr of engine operation, instrument automatically restarts at zero.

Towmotor Corp, Cleveland, Ohio

Whitnon spindles for surface grinders permit finishes up to 2½ to 4 micro in. Spring preloading keeps wheel chatter-free under radial and axial loads; extra rigidity allows wheel to spark out very fast. Spindle assembly is balanced on its own ball bearings. Regardless of wear or temperature changes, the self-adjusting feature permits a high degree of finish, enabling limitation of lapping.

Whitnon Manufacturing, New Britain, Conn

Klem water wash compound No. 203, designed for reclaiming of paint from spray booths, eliminates nightly draining of tanks. Product may be used up to 7 days before draining is required. Circulation lines, water pumps, flow control nozzles, and baffles have been reported free of paint sludge at end of period in production tests.

Klem Chemicals, 14401 Lanson Ave, Dearborn, Mich

Line of self-contained, portable emery hydraulic weighing units, said to be accurate to 0.1% of scale, can be furnished in sizes up to 50 tons. Units are available in 24 ranges from 0-500 lb to 0-100,000 lb. There are four load cell sizes with a choice of 8½-, 12-, and 16-in. indicators. Indicator is mounted directly on hydraulic force-measuring cell. Accuracy in use is guaranteed to be within 0.25% of full scale.

The A H Emery Co, New Canaan, Conn

Royal-Arc hand portable electric welder, utilizing 110/220 ac, has a heat range of 15 to 200 amp, welds any metal up to extra-thick steel plate. Electrodes used are from 3/64 to 5/32 in. The 65-lb unit welds, brazes, solders, cuts, or preheats, using either the metallic or carbon arc process.

Royal Equipment Corp, 906 Main St, Burbank, Calif

Backstand Belts save 2 hours per day!

Armour Backstand Belts save 2 full hours per operator per day for steel tube company*

In removing burrs and grip marks from steel tubing, a well-known company* found they saved more than just the two hours per day operators had been given to make set-up wheels. Backstand belts outlast 4 to 5 set-up wheels—and without dressing they remain flat and true. And backstand belts give a better finish, due to their uniform grit.

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in grit size, backing, etc. We have sheets, discs, rolls, tubes—and specialties to meet your specifications. Your industrial supply distributor will tell you about this complete line. Call him today!

And, today—mail the coupon below for your free copy of our booklet, "How to Store Coated Abrasives." It can help you, too!

*Name of company available on request

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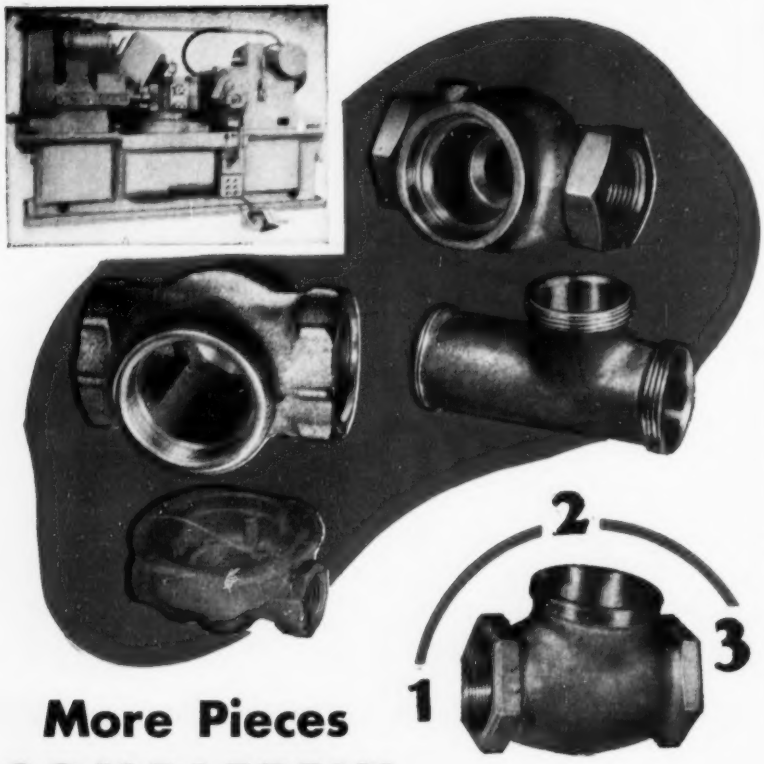


More Pieces COMPLETELY *finished in less time on* GOSS & DeLEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & DeLeeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

●

Send for illustrated literature which fully describes this recent Goss & DeLeeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS & DeLEEUW

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A*

Model 55, added to the Methaspec Eye-Savers line, incorporates plastic Retrax telescoping templets, adjustable to every face. Lens-angling device enables wearer to adjust eye shield properly to suit job requirements. One-piece methacrylate lens, 0.080 in. thick, is available in varied green shades, or clear with black eye shields.

Watchemoket Optical Co, 232 W Exchange St, Providence, RI

Reuland hollow-shaft motor, used in conjunction with a magnetic brake, permits motor's shaft to be extended entirely through the brake, eliminating dead-ending of one end of shaft within the brake. Shaft passage is kept open for rams or punch-out rods, which can pass entirely through motor and brake. Brake permits fast, automatic starting and stopping for repeated insertion and removal of work. Applications include lapping, honing, spinning, and turning.

Reuland Electric Co, Alhambra, Calif

Iridium radiography sources are available for non-destructive testing of steel from ¼ to 1 in. with high sensitivity; provides 2% definition in steel, and gives good results on aluminum and magnesium. Low-energy gammas of Iridium-192 allow thin sections of materials to be radiographed, revealing flaws which would be undetectable if high-energy gamma sources were used.

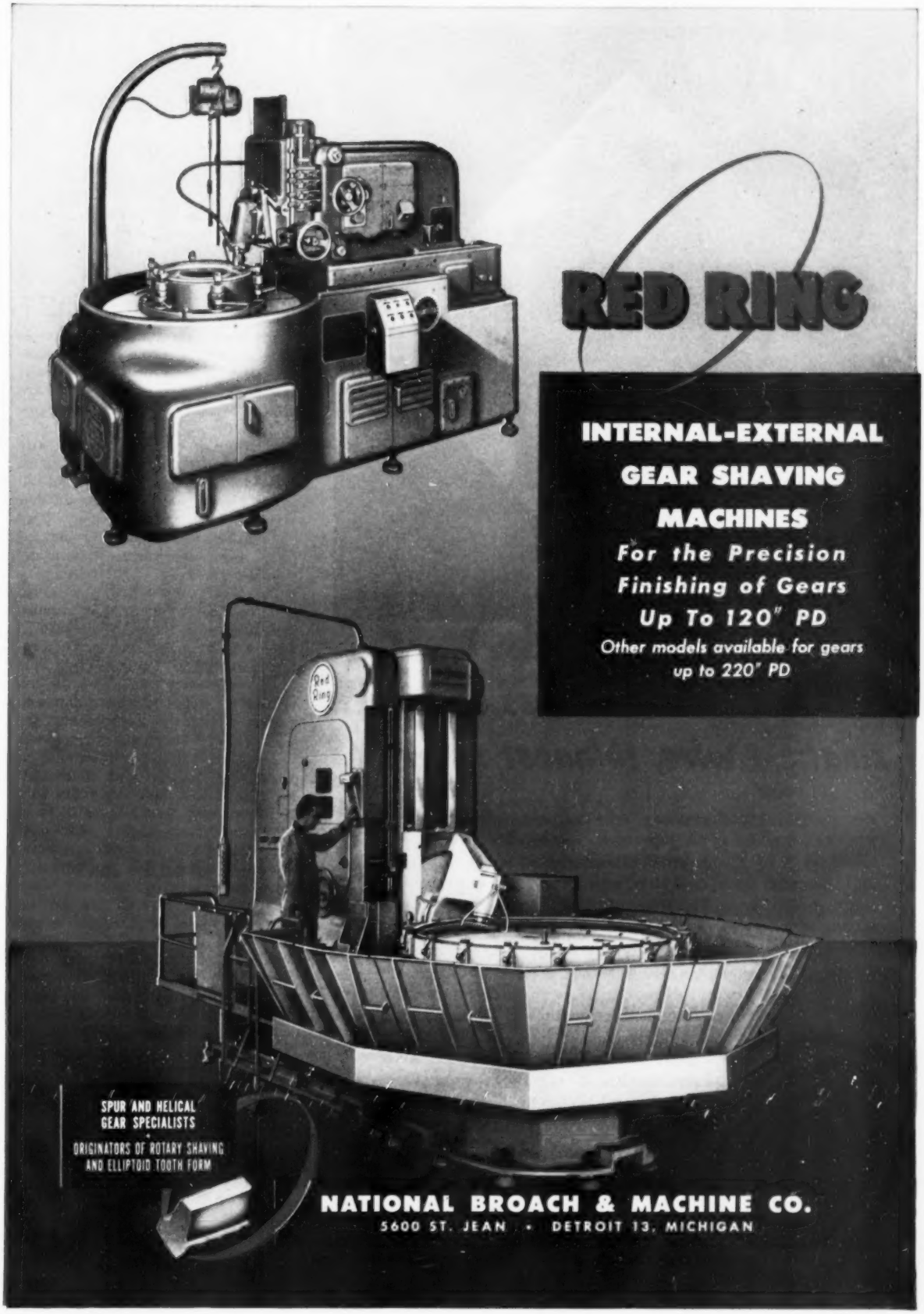
Tracerlab, 130 High St, Boston 10, Mass

Austenitic alternate for 18-8 stainless has been developed with good working properties, weldability, and ductility. Chromium manganese stainless, containing less than one per cent nickel, is available in strip and most other forms.

Allegheny Ludlum Steel Corp, Pittsburgh 22, Pa

Coolant tube, made of Neoprene rubber, can be twisted into almost any shape; copper core design keeps it so twisted until re-shaped. Sagging and drooping is eliminated, coolant maintains uninterrupted flow on the work. Tubes need not be wired or taped into position, consequently, coolant can be directed into previously inaccessible places. Units available in most diameters and lengths, with any length tip.

Acrobat Co, 1923 Vineyard, Los Angeles 16, Calif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INTERNAL-EXTERNAL
GEAR SHAVING
MACHINES
For the Precision
Finishing of Gears
Up To 120" PD
Other models available for gears
up to 220" PD
SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM
NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN • DETROIT 13, MICHIGAN

an ACCO product

TUKON TESTER for MICROHARDNESS TESTING

TUKON—Tests hardness of even smallest wire, thinnest sheets

Because the TUKON applies a light load and definitely locates the exact position of an impression, you can use it to test the hardness of small wire .001″ diameter, thin metals less than .001″ diameter thick, or shallow superficially hardened surfaces less than .001″ deep. The shape of the Knoop Indenter permits testing of jewels, glass, and plastics.

TUKON Testers for micro and macro hardness testing were designed for researchers and scientists who require precision and repeated accuracy. Now, due to its advantageous design, it is finding its way into production control. Three models cover the range of diamond pyramid testing, both Knoop and 136 degree. All are complete, self-contained instruments. Each is carefully inspected and checked for accuracy and uniformity of readings by technicians in Wilson's Standardizing Laboratory.

Write for literature. Tell us the nature of your work and we'll gladly make recommendations.

ACCO

WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

230-B Park Avenue, New York 17, N.Y.

TRADE MARK

WILSON "ROCKWELL" and TUKON Hardness Testers

ROUND TABLE Discussion

RUSTY

Does a man lose touch—become rusty—away from his trade? Should you hire back an ex-toolmaker who hasn't been at the job for the last ten years? Here's what readers think . . .

Webster's dictionary has this to say, among other things, about rust, "loss of power by inactivity." Which would seem to fit the case of the man who leaves any trade or profession to follow another line of endeavor, and then after a period of years decides to return and pick up where he left off.

In the case of Ed's toolmaker, this loss of power by inactivity would take some time to regain and he would not be quite as good an employment risk as the fellow whose application showed he had remained at the business since his apprenticeship days.

But I certainly disagree with Ed and his flat statement that absence from the trade for such a length of time would cause a man to be practically worthless. During World War II we saw men come back to the shop after years of retirement and within a few weeks get back in the groove as if they had never been away. How about the thousands of young toolmakers and machinists who spent four and five years with the Army and Navy? Some of those boys may have had a chance to keep their hand in working in Service repair shops, but the majority must have been quite rusty when they got back to civil life, yet industry absorbed them without noticeable difficulty.

While admitting that there have been innovations in methods of manufacture during the past ten years, I also take issue with Ed's statement that a former toolmaker would have to be retrained in order to cope with these technical changes.

If a man has been thoroughly grounded in the fundamentals of his trade and hasn't forgotten how to read blueprints and measuring tools, I see no reason why an absence of ten or twenty years should debar him from a chance to get back into a toolmaker's apron again. To be sure, I wouldn't start him off at top toolmaker's rate, or put him to work right away on the most complicated job in the shop. That would

SPECIAL *Chill* CAST BRONZE GEARS

HARDENED AND GROUND STEEL WORMS

Advantages of Philadelphia Worm Gear Reducers

To insure long, dependable service from Philadelphia Worm Reducers, the greatest care and research goes into the selection of materials for the worms and worm gears. The predominant sliding action dictates the use of dissimilar metals to minimize frictional wear.

Philadelphia Worms are of alloy steel with hardened threads. Shaft and threads are smoothly ground and polished after hardening. The result is increased gear life through improved surface finish.

Worm Gears are of high quality chill cast nickel bronze to provide greatest strength, with a low coefficient of friction against the worm.

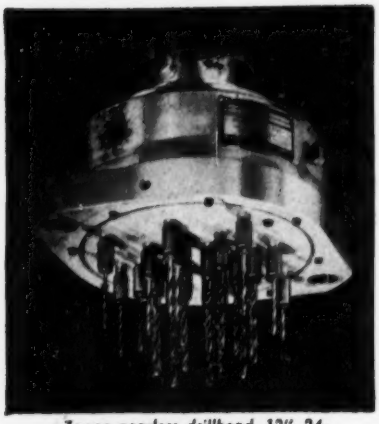
These and other features of Philadelphia Worm Gear Reducers are explained in detail in our Catalog WG 51 . . . send for a copy.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Zagar gearless drillhead, 12", 24-spindle; capacity up to 5/8" steel.

Zagar GEARLESS DRILLHEADS *excel* for drilling on close centers

Their unique features have earned for Zagar gearless drillheads a permanent place in many industries. Examples: gas burners, acoustical tile, parts for aircraft (jet engines), business machines, electrical appliances, automotive and farm machinery; drilling cast iron, stainless steel, paper, fiber glass, magnesium, aluminum, brass and copper.

Why this versatility? Because Zagar gearless drillheads (1) can drill practically any number of holes at one pass, up to 600 or more; (2) can drill any material; (3) can drill in any pattern; (4) can "come down to" distances between holes as small as twice the drill diameter; (5) can and do maintain accurate spacing. High production thus combines with complete accuracy to deliver more work and more acceptable work in less time than ever before. Zagar gearless drillheads can be furnished as complete units or can be adapted to any standard drill press. Your parts drawings and full data will bring you a prompt quotation.

Write for Engineering Manual "A-8" for more information on Zagar's tools for industry.

ZAGAR TOOL, INC.
24000 LAKELAND BLVD.
CLEVELAND 23, OHIO

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

be a disservice to the company and to the man himself. I think the fair thing to do in such a case would be to start the man off on the simpler jobs until he got back his touch, grading his wage rate in accordance with his progress. Any foreman who turns down a man who shows promise of being a potential asset to his shop, especially during a period of skilled labor scarcity, is certainly not acting in the best interests of his company.

There are many reasons why some men quit the trade apart from ill health. Usually it is because they see, or think they see, a chance to make more money, or at least make it faster than would be the case in the shop. I have known such men and some of the reasons; one quit to become a circus acrobat, another to go into vaudeville, still another to become a professional ballplayer. When their wandering days were over they came back to the trade and a steady paycheck and so far as I know no one questioned their right to pick up the threads again. On the contrary, the boys were glad to see them and did all they could to help them get back into the groove again.

Which leads me to believe that Ed's dogmatic dog-in-the-manger attitude is a personality kink that makes him different from the average foreman.

Robert S Alexander
Greenville, RI

The idea that a man loses the feel for engineering when he has been away from it for a long time is quite common, but the facts seem to point out that it is a fallacy. Not only do prospective employers worry about it but the man himself is apt to lose confidence in his ability to pick up the job where he left off several years before.

Provided a man spent several years before reaching the age of 20 in learning his trade, it is very unlikely, in my experience, that he will ever forget the feel for machine tools and metalworking processes. In my own case, I have been away from actual machine tool using for five years at a stretch, but when circumstances have forced me take a job at the old game of iron fighting I have been able to attain the old facility in handling tools that I was afraid I had lost.

During the recent war, I was acquainted with men who came back to the machine shop from retirement or who had been forced to close down their small businesses because the war made them redundant. These "retreads" were just as good as the men who had been on the job continuously. In every case, the good men were those who had served an apprenticeship of several years in their young days.

It is not fair treatment to hold a man's desertion of the toolmaking trade against him. Just because a man has left the trade in order to better his circumstances, it does not necessarily hold good to say that he will quit it again should a suitable opening occur in some other field of activity. Anyway, how does it concern the employer? Either the man can cope with the job or fall down on it. He should be judged on actual results and his past history should not prejudice his employment.

The toolmaking and skilled engineering trades breed a type of individual which is, to my mind, of a superior level of intelligence to any other, and it is a common occurrence for such men to have dual and even treble outlets for their manipulative skill and ability to originate things. Thus we have skilled players of musical instruments, painters, fine craftsmen in wood, expert gardeners, photographers and even writers. The man who is given an opportunity of working full time at his hobby naturally takes on the job and usually makes good at it. I have met many of these men who have given up actual iron fighting for a living, but who have

"I don't know, he gets rid of the cuttings so I just let it go at that."

FOR THOSE TOUGH *Special* JOBS
...DEPEND ON

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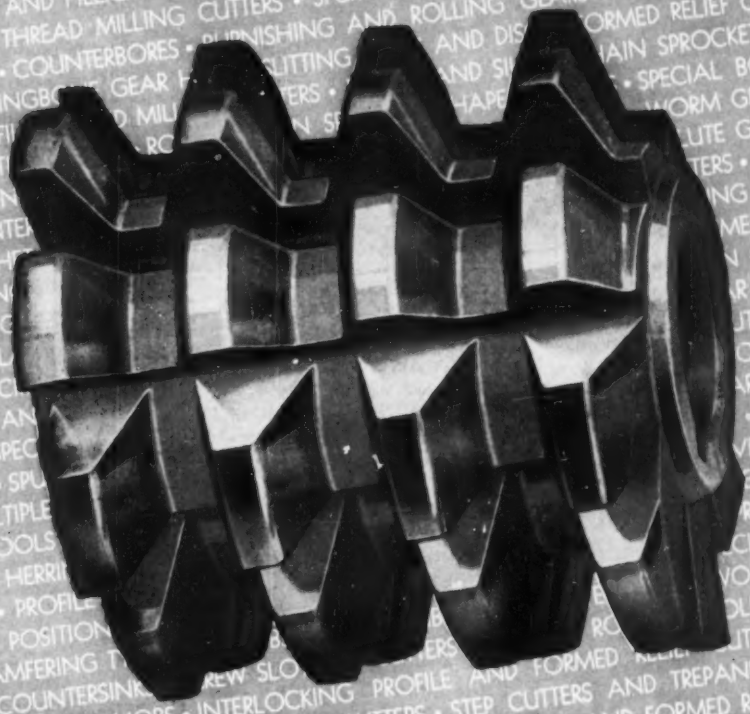

Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

Since 1905 **engineers and manufacturers of high-quality special cutting tools for the metal-working industry**

National Tools Cleveland

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TOOL CO.
Cleveland 2, Ohio

converted their old occupation of toolmaking into a hobby. The feel and enjoyment of using tools is never dropped by such individuals who become enthusiastic home workshoppers.

Much as a man may like his job of toolmaking as regular employment, it has the defect of other regular employment in that its regularity becomes monotonous. There is a contented type who can punch the same time clock for 25 years or more and work within the same four walls with a bovine stolidity. Unfortunately, such plodders are not given to flights of imagination or creative ability in any field of activity—including toolmaking. The best men with ideas and skill are more mercurial and, while giving their whole attention to their jobs, are worth three of the steady plodders.

Toolroom superintendents cannot have it all their own way; if they want steady workers they will have to endure the cow-like types who have not had a new idea in twenty years. If they want quick and active workers who can operate on their own initiative in an independent manner and not require spoon feeding, then they will have to endure the men who often make changes and who are likely to emigrate to Australia without warning, or leave on the next balloon race to China.

This idea that the man returning to the toolmaking fold will be out of touch with modern practice is the biggest fallacy of the lot. In the first place, toolrooms are not noted for progressive ideas in machine work, particularly press tool shops. It is highly probable that the man who is returning to toolmaking after several years' absence will be shocked and astonished at the lack of progress made in equipment and methods while he has been away.

I have just been reading an old book on toolroom practice which was published about 40 years ago. Any man who learned press toolmaking

"But it's not leaping before you look when you spend all morning looking."

NOTICE

The New

SIBLEY MODEL D DRILLING MACHINES in 24" and 28" SWING

An operator gains greater productivity from the ease of control offered by the new Sibley Model D. The V-belt drive is direct to a 4-speed geared transmission, controlled by a conveniently located lever. A 4-station switch at the front of the machine includes an "inching" button to facilitate changing speeds.

Three optional ranges of spindle speeds are available: 21 to 365 R.P.M.; 25 to 419 R.P.M.; and 37 to 650 R.P.M. Standard equipment includes automatic spindle stop; geared power feeds; back gears.

The Model D handles a wide range of precision drilling jobs with a head travel on the hand scraped column of 25" and a spindle feed of 11". Drilling capacity is 1¾" in mild steel. The heavy table arm assures rigidity and swings on column, to make the machined base accessible for a working surface.

Model D-24 Drilling Machine is illustrated complete with coolant pump and fittings, electrical reversing, 5 H. P. motor, magnetic starting switch, and rectangular oil groove table.

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The selector is unique because it starts with the ultimate use of the steel. It breaks down all tool steel applications into six major classifications, under which the different grades of steel available for certain specific requirements are indicated in legible cutouts. Heat treatment and machinability data are also included for each grade.

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HERE'S AN EXAMPLE:

Application — Deep drawing die for steel

Major Class — Metal Forming — Cold

Sub-Group — Special Purpose

Tool Characteristics — Wear Resistance

Tool Steel — Airdi 150

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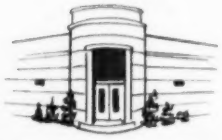
Had a swell new product • • •

But, he couldn't figure out a way • • • to make more than 100 a month . . . without a big capital investment

Until he talked to Pioneer Engineering • • • • •



Now, he makes 1200 a month, and his manufacturing costs are cut in half without adding any men or machines!

Everyone knows the best way to cut costs is through increased productivity. Contrary to the conception of increased production only through more men and machines, Pioneer does it a better way

Take the product mentioned above for example. We made a complete product manufacturing study of the unit. This included tolerance liberalization, interchangeability of parts, functional requirements of parts and overall economy of production.

Our study, coupled with correct functional design and the reprocessing and design of proper tools and gages cut manufacturing costs 50% and increased production 1200%.

And the product manufacturing study cost only $1800!

Write today for Bulletin 162-A which describes our complete engineering services in detail.

Pioneer ENGINEERING & MANUFACTURING CO., INC.

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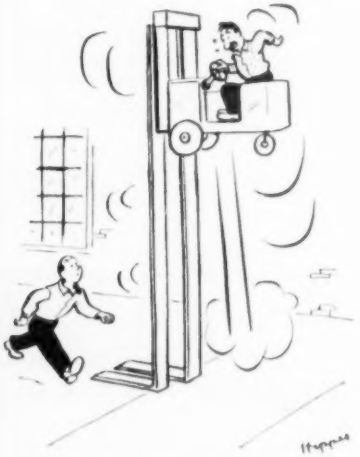
under the difficult conditions prevailing at the turn of the century will regard present practice as kid stuff. Instead of wrestling with toolmaker's buttons he should have a jig borer available; instead of trying to develop a sensitive feel for rule and caliper work he can now use precision gage blocks and dial indicators. Instead of having to lap out hardened bushes to size and roundness he can use an internal grinder. All the above equipment has been designed to make toolmaking easier. The basic principles of the milling machine or engine lathe are the same no matter how much you streamline the machine's carcass and cover it with knobs and dials.

The older man probably learned his job in a school of very hard knocks, and with very little in the way of equipment to help him on his way. He ought to be given a chance to show what he knows and, provided that his mind is still in a fairly malleable condition, he should prove a distinct asset to any modern tool shop.

Clifford T Bower
London, England

A man may become a little rusty away from his trade, but there is nothing like a good brush-up for removing the rust. Where an experienced worker who stayed off his trade for a length of time applies for reemployment, I believe he should be hired if needed, and put through some remedial training to bring him up to date with new methods of doing work, and how to improve past performance. Where the background material is there, it should not be too difficult to round out the man's skills in line with current practices.

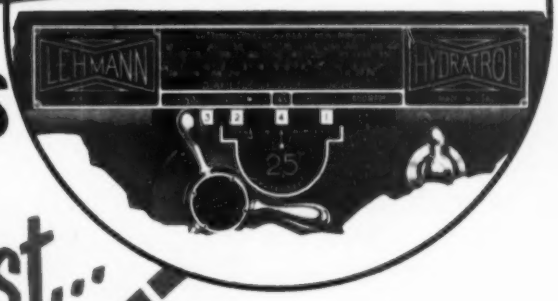
An oldtimer often possesses skills which a younger man may lack. To

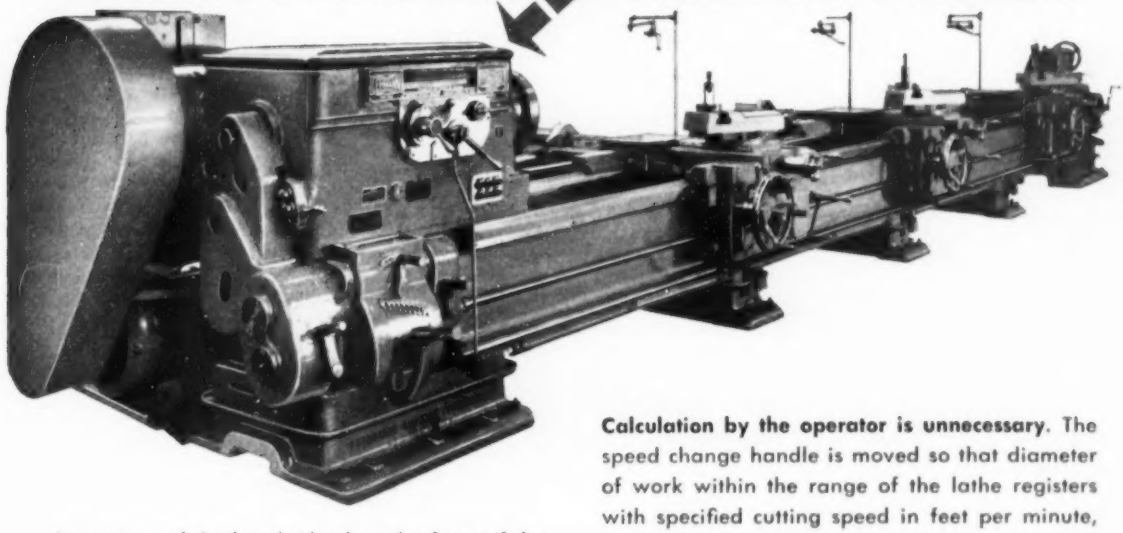


"Somehow she got into reverse!"

THE BIG HYDRATROL STORY:

16 Spindle Speeds *with only a* Twist of the Wrist... *with This Automatic Slide Rule Selection!*





Just a turn of the hand wheel on the front of the headstock of the LEHMANN Hydratrol Lathe gives you a speed change! An automatic slide rule, co-ordinated with the movement of the handle, shows spindle revolutions per minute and indicates a slide rule calculation of the cutting speeds in feet per minute.

Calculation by the operator is unnecessary. The speed change handle is moved so that diameter of work within the range of the lathe registers with specified cutting speed in feet per minute, and the lathe automatically makes the necessary change.

The rotary selector gives 16 forward and 8 reverse speeds. No need for intermediate stop; unnecessary to disengage the friction driving clutch to change speed.

Check These Other Important Advantages:

- **Safe in operation.**
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- **Hydraulic friction clutches and hydraulic brakes, self-compensating.**
- **Automatic safety relay, for harmless and easy engagement of positive clutches when speeds are changed.**
- **Spindle release for chucking.**
- **Perfect, safety-control lubrication with filtered oil.**
- **Gears constantly in mesh.**

Write today for additional information or catalog—or—send prints for time-and-money-saving recommendation!

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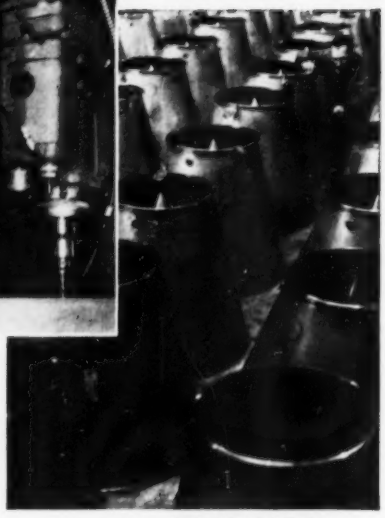

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Precision-Drills

JET EXHAUST CONES

4½ Times Faster WITH 4 DELTA

Air Powered Hydraulic DRILL UNITS

Four DELTA Drill Units at Ryan Aeronautical Company drill 160 precision holes . . . in forty minutes . . . through flanges of exhaust cones for jet engines . . . AND they do it to tolerances of —.001. With conventional machines, the job required *three hours*. The entire process is automatic. The operator simply presses a button . . . simultaneously actuating four drill units. They rapid-traverse to the work . . . drill at uniform feed through the tough stainless, then automatically rapid-retract without operator supervision.

Mr. Floyd A. Cox, Superintendent at Ryan, states: "Delta drill units are well designed to accomplish this job, and have proven their effectiveness in the work we are doing with them. The objective in drilling these stainless steel products is to bite into the work with consistent speed and rotation, and to maintain constantly homogeneous chip removal. These Delta drill units are driven by electric motors which provide steady, uniform rpm, and the air pressure actuating mechanism which operates the integral hydraulic feed insures absolutely even penetration."

This Delta Air-Hydraulic Drill Unit Can CUT COSTS For You!

Ryan Aeronautical, on the alert for ways to get better production at least cost, cut expense of this operation by at least 50% . . . with DELTA Air Powered Hydraulic Drill Units . . . for fully automatic multiple operations.

You'll appreciate "Why" when you check these 12 reasons:

1. Quick set-up . . . No cams used.
2. Rapid approach and return.
3. Positive control of approach and stroke.
4. Approach repeats to within .010 inch—final depth to within .0005 inch.
5. Rugged and simple in operating principle.
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11. Can be mounted in any position.
12. Completely versatile—infinite variations of control.

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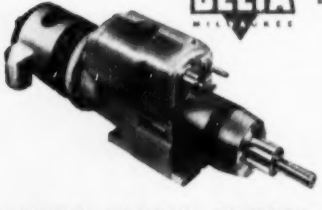

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lose the use of these skills by arbitrarily refusing to hire the older man because of age or the fact that he was away from his trade for a length of time is missing an opportunity to obtain a valuable worker.

In any modern plant, new workers are taught to do their jobs correctly from the outset. Why shouldn't channels exist to teach old employees or rusty individuals new methods? Given a chance to nimble up his fingers and be indoctrinated in the newer methods of manufacture and use of improved machine tools, the rusty individual may turn out to be a better worker than his modern brother.

In most large plants, operators are transferred from one department to another. These men must be retrained before they can begin production work. In this category, the returned or rusty worker can be included under the training process to be transformed into an efficient part of the working force. Where conditions permit, the returned worker should be given a brush-up training by the supervisor. In this way the man is provided with a good opportunity for getting acquainted with his boss, and in turn, the foreman has a good chance to judge the ability and possibility of the rusty worker from the job-performance standpoint. Whenever the supervisor can give adequate time to retraining the returned worker, it is a most economical way of achieving satisfactory results.

A worker who has been away from his trade should be considered in the same light as a new employee as regards indoctrination on a new job. Of course he possesses skills that no hiatus in the practice of his trade can adversely affect. A good brush-up for the rusty employee should include instruction regarding new

"After 25 years on this job they give you the usual small watch, I hope!"

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greater cutting mileage

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TOP PERFORMANCE . . .

LONGER TIME BETWEEN SHARPENINGS

GREATER CUTTING MILEAGE gives users of Double Circle Tools the economical performance so important to efficient manufacturing. Longer time between sharpenings means more steady production resulting in a savings in time and money. Longer life . . . is the extra value that stretches every dollar you invest in tools. Top performance is the smooth precise operation that users enjoy . . . enabling them to turn out better workmanship with less effort.

CHICAGO-LATROBE has demonstrated that all the extra time, thought and expense placed on careful quality control has produced TOP QUALITY TOOLS of real benefit to users. That's why it pays to specify Double Circle Tools . . . and enjoy GREATER CUTTING MILEAGE.

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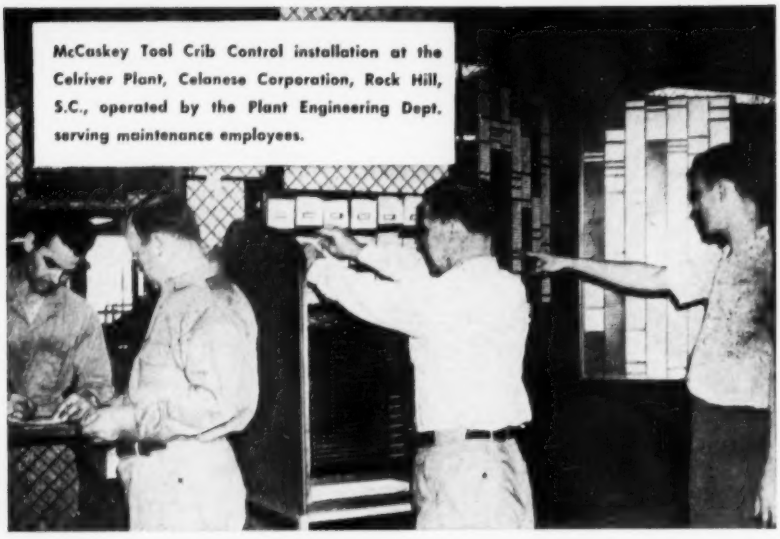

McCaskey Tool Crib Control installation at the Celriver Plant, Celanese Corporation, Rock Hill, S.C., operated by the Plant Engineering Dept. serving maintenance employees.

Celanese Corporation of America Employees and Management approve McCASKEY TOOL CONTROL

"Provides better labor relations . . . reduced tool purchases", to quote Mr. B. A. Morgan, Jr., Maintenance Engineer. Here's his complete report:

"We installed McCaskey Tool Crib Control at the beginning of plant operations and have found that our tool loss has shown a continued downward trend.

"The employee likes this system much more than older methods such as 'picking up brass', etc. It is a positive means of his protection against mistaken charges, as his signature and ticket number must match up with both his receipt and that of the Tool Crib Attendant's.

"The Company likes it because it speeds up operations; makes for better labor relations; and is practically fool-proof. We can locate a loaned tool almost instantly and thus save duplicate purchases of many expensive items."

Let us send proof of substantial savings in both large and small plants . . . or have a qualified representative explain how McCaskey Control will improve your operations.

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The McCaskey Register Co., Watford, England

equipment and materials to be used on the job, the care and use of the newer tools, safety rules and regulations, and particularly, safety requirements in connection with the job for which the worker is being indoctrinated. He should be given information on the flow of work to and from the work station, including information about requisitioning, handling materials, and processes. Sources of information about the job —that is, where to find data, what literature is available, what persons to approach to ask questions about the work itself, should be given to the returned worker. The brush-up should include correct methods for doing the work, short-cuts, and quality requirements of the job.

To make sure that the rusty worker has not become too rusty away from his trade, a follow-up is necessary. It may be a condition in some men that being too long away from a skilled trade may have caused some deterioration in their know-how. That depends on the man's physical and mental conditions, a state of affairs that varies with the individual. It is not enough to retrain the worker and then put him on his own without further ado; it is necessary also to follow up what the worker does, and to obtain progress reports. These are in reality reports on what the operator has done during the previous day, week, or work period. It is necessary to check in particular on the quality of the work done by the returned worker, the amount of spoiled materials which have resulted from his work, and the probable errors in performance which have caused the loss or damage.

In one plant of which I have knowledge, the brush-up procedure for a returned worker who had been away from his trade for a period of time consisted of having him work with another experienced employee doing the same type of work. It was found that this method was more

"If you don't marry me pretty soon I'll be so independent you won't like it a bit!"

satisfactory than direct retraining by the foreman himself. Working with another employee, the rusty individual was found to be more apt to ask questions than he was from the supervisor. The experienced worker appreciated the attitudes and feelings of the returned worker and was in a position to put him at ease quickly. It was also found that the operator who did the retraining improved his own methods of work through brush-up teaching.

One trouble today is that so many people try to learn the tricks of the trade instead of learning the trade. That is why I believe that an old-timer who knows the fundamentals of his trade from previous long experience will prove to be a better man to hire than one of those jittery moderns who seems to know the tricks and not the trade itself.

As regards hiring an older worker, it should be remembered that neither a man's skill nor his usefulness depends directly on his age in years, but on his ability to perform useful work, or direct others with less experience. Experience, properly evaluated and used, will prove an asset to the employer. Age alone is not a good guide as to a man's ability.

How to handle the worker who starts in again should not be by a hit-or-miss scheme. He is a new employee and should be effectively introduced to the company and to his place in it. The returned worker should not be assigned to a department and left to sink or swim or shift for himself. Getting the rust off his skills should not be a trial-and-error adjustment proposition, in which a man finds his own niche or gives up and quits.

Harry Kaufman
Philadelphia, Pa

•

CRAZY NUMBERS

Are detailed cost reports of specific value to the busy foreman, or will he tend to ignore them as a waste of his valuable production time? How can they be best presented?

There is a great deal to be said for the cost report, because every foreman likes to know how he stands in relation to other departments in that important element, as well as using it as a yardstick to check the operations of the previous week or month.

However, I think management should endeavor to keep the cost report as brief and simple as possible, so that the busy foreman can digest it along with the other paper work

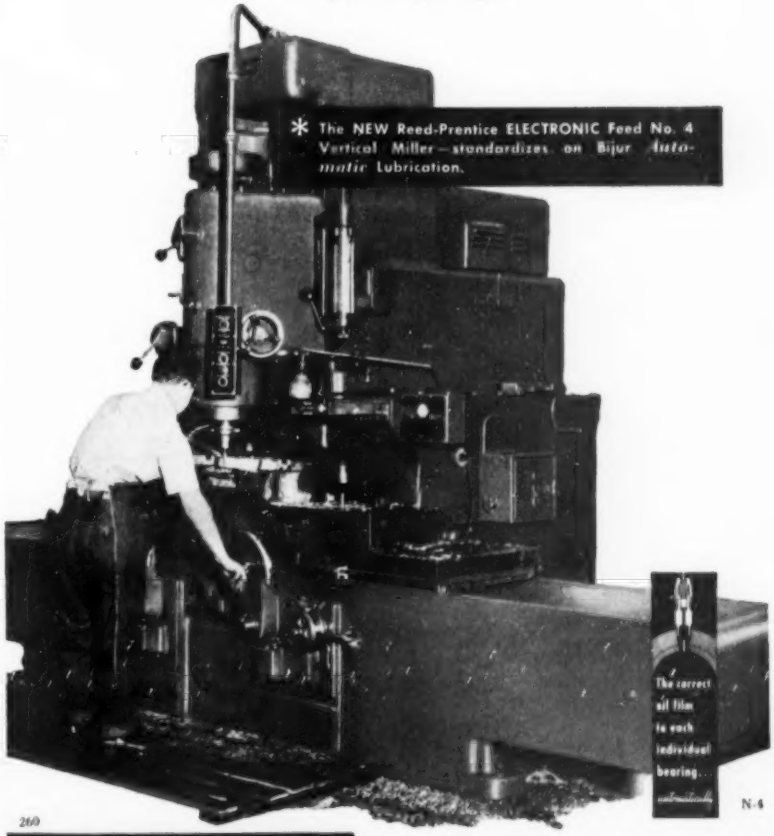
ANOTHER New Machine...

BIJUR *lubricated**

Production doesn't lag on the versatile new Reed-Prentice Miller—electronics control feed of the work just as *fast as the cutting tool can handle it!*

To safeguard this machine under maximum output, Reed-Prentice and Bijur engineers devised a compact, built-in lubricating system that protects important bearing surfaces—and does it *automatically!*

Bijur's years of experience in solving thousands of lubrication problems is always available to machine manufacturers. A Bijur engineer can design a complete lubricating system for your machines now in production or in the planning stage.


* The NEW Reed-Prentice ELECTRONIC Feed No. 4 Vertical Miller—standardizes on Bijur *Automatic* Lubrication.
The correct oil film to each individual bearing...
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260

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Rochelle Park, New Jersey
Pioneers in Automatic Lubrication

O. K. Pete! From here on in shave at home. I know how razor sharp Clarite Tool Bits are!

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels—High Speed Steels Die Steels—Hot Work and Shock Resisting Steels Carbon Tool Steels.

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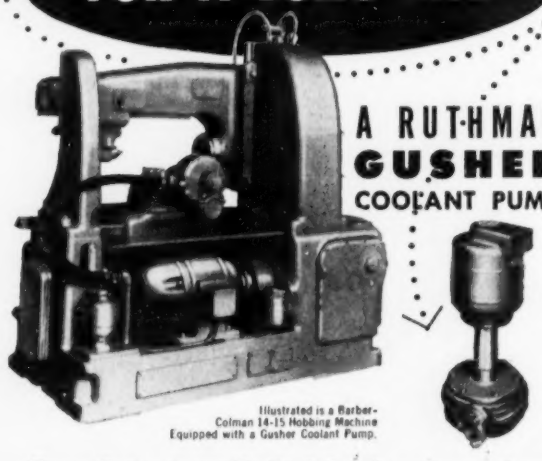
FOR A LONG LIFE

A RUTHMAN GUSHER COOLANT PUMP



Illustrated is a Barber-Colman 14-15 Hobbing Machine Equipped with a Gusher Coolant Pump.

Every Gusher is specifically designed to give you long trouble-free service.
The rotating assembly is electronically balanced to eliminate vibration and wear. There's no metal-to-metal contact within the pump.
The overall construction is extremely simple with fewer moving parts.
Wear and maintenance costs are cut to a minimum.
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THE RUTHMAN MACHINERY CO.

1818 Reading Road, Cincinnati, Ohio

that has a tendency to accumulate on his desk. For no matter how valuable the data contained in it, any report that runs close to a dozen pages containing columns of figures requires considerable concentration—more concentration than a foreman has time for in the average eight-hour day.

So, if the foreman is not the type who believes in taking his work home with him, the report gets a sketchy reading when he can spare a few minutes and eventually finds a resting place in the well-known "circular file." Which is regrettable, for someone in the front office spent a great deal of time and brain-sweat compiling a cost report that was correct even to the broken tap that Joe Doakes threw under the bench. So far as this type of foreman is concerned, the lad in the front office might be compared with the mountain that labored and brought forth a mouse.

Of course we will admit that there are foremen who make a definite effort to read and digest even the most voluminous report, even to the extent of taking it home to compete with television and the social side of a foreman's life, and while some do manage to dig out some facts of constructive benefit, the majority are inclined to yawn themselves to sleep over it.

I agree with Al that the average foreman spends most of his working days in a battle to keep costs down and production up in his own department, usually with some success. While he appreciates the necessity for a monthly, bi-monthly or even weekly cost report, he would consider it more valuable if it were boiled down so he could assimilate it along with the other data that arrives with his morning mail.

Failing that, I am of the opinion

"May I assume this means you'll be wanting a new machine, Creighton?"

Lighter . . . faster Rotor grinders

"PAID OFF" in 48 days

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Call in your Rotor Application Engineer for a study of your portable tool operations to suggest improvements. Write for Catalog No. 38.

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FASTER . . . Rotor Grinders, known as the "Power Plus" line are recognized everywhere for their high speed *under load.*

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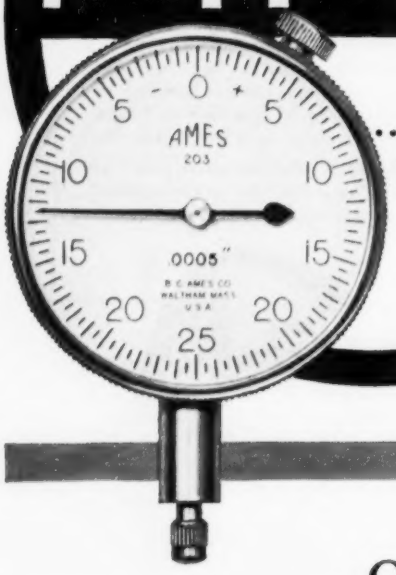

...the preferred Dial Indicators

One of America's largest and most famous mass-producers recently chose Ames as preferred source of supply for indicator gauges.

The reasons behind this decision are the very reasons why *you* should standardize on Ames dial indicators and dial gauges:—the Ames "Hundred Series" indicators available in four sizes, fit every measuring requirement; they are *accurate, sensitive,* low in friction, yet are *rugged* and *tough*—give *more* on-the-job time. All Ames products embody latest design and highest-quality materials; they are manufactured by methods and machines that are *exclusive* with B. C. Ames Co.

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Ames Dial Micrometer No. 517

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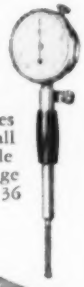

Ames Small Hole Gauge No. 36

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Representatives in principal cities. B. C. AMES CO. *26 Ames Street Waltham 54, Mass.*

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that no foreman would object to staying over at the end of the working day for an hour or so, say every time the cost report came out, to listen to an explanation of it and perhaps ask some questions. I think he would get more out of it than if the report was just dumped onto his desk and left to his own judgment. There is no doubt in my mind of the ultimate benefit of a meeting of minds in this problem. I am sure the foremen, the cost department, and finally the company, would gain by it.

Robert S Alexander
Greenville, RI

Al is right; to the foreman of a production department, a mass of tabulated figures covering a dozen pages or so has little meaning.

Al is used to visualizing things. He can pick up a blueprint and see a finished part or a machine ready to start production. He knows just what the designer was trying to indicate on paper and he can immediately go ahead and produce the parts or the machines by the hundreds, if they are wanted in quantity. Show these same blueprints to the firm's auditor and he won't have the foggiest idea what it is all about but give *him* the tabulated and consecutive lists of labor, equipment, and materials costs and overhead, amortization, depreciation, and other charges, and he can see the business trend, and whether profits are on the increase or whether labor, overhead, materials, etc, are starting to smother the business and bring disaster. In general it is as much of a waste of time to dump a lot of tabulated figures on the shop foreman's pine-top desk as it would be to dump an armful of blueprints on the mahogany desk of the firm's accountant.

Don't misunderstand the situation, though; it is most important that the foremen as well as the superintendent be kept thoroughly informed not only of the present status of the business, but also on the trend of

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DRILLING PROBLEM

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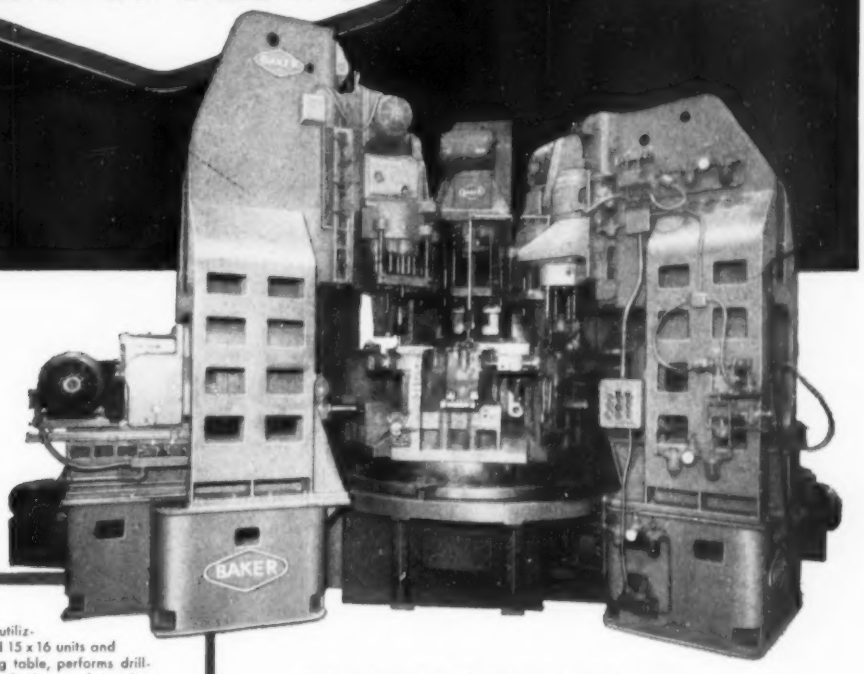
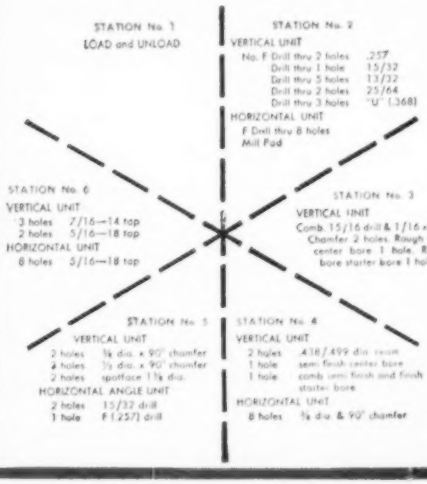


Baker Multi-Operation Machine utilizing standard Baker 7½ x 16 and 15 x 16 units and a 72" six-station power indexing table, performs drilling, chamfering, boring, counterboring, and tapping operations on clutch housings at the rate of 80 parts-per-hour at 100% efficiency.


STATION No. 1
LOAD and UNLOAD
STATION No. 2
VERTICAL UNIT
No. F Drill thru 2 holes .257
Drill thru 1 hole 15/32
Drill thru 5 holes 13/32
Drill thru 2 holes 25/64
Drill thru 3 holes "U" (.368)
HORIZONTAL UNIT
F Drill thru 8 holes
Mill Pad
STATION No. 3
VERTICAL UNIT
Comb. 15/16 drill & 1/16 x 45° Chamfer 2 holes. Rough bore center bore 1 hole. Rough bore starter bore 1 hole.
STATION No. 4
VERTICAL UNIT
2 holes .418/.499 dia. recess
1 hole semi finish center bore
1 hole comb. semi finish and finish starter bore
HORIZONTAL UNIT
8 holes ⅛ dia. & 90° chamfer
STATION No. 5
VERTICAL UNIT
2 holes ⅛ dia. x 90° chamfer
4 holes ⅛ dia. x 90° chamfer
2 holes spotface 1⅛ dia.
HORIZONTAL ANGLE UNIT
2 holes 15/32 drill
1 hole F (.257) drill
STATION No. 6
VERTICAL UNIT
3 holes 7/16—14 tap
2 holes 5/16—18 tap
HORIZONTAL UNIT
8 holes 5/16—18 tap

Baker Special Drilling Machines, composed of standard Baker units arranged to suit each individual problem, are designed for *productivity*. Units arranged in vertical, horizontal and angular planes perform multiple operations *faster . . .better . . . automatically . . .* with greater accuracy and efficiency. Consult Baker engineers for a better solution to your drilling problems.

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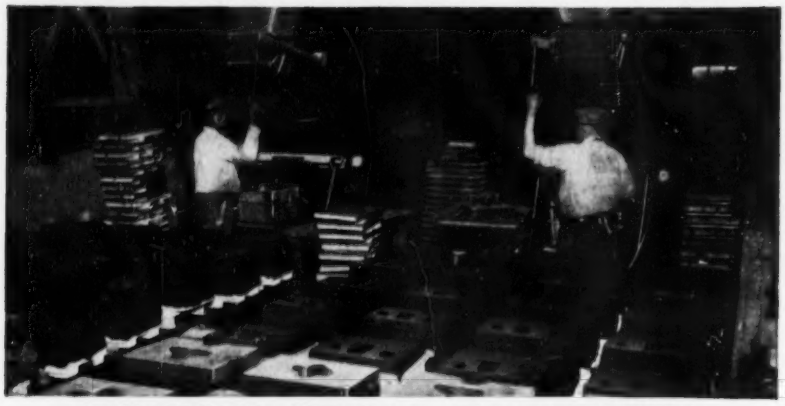

FASTER FROM BALDWIN

New equipment and regrouped facilities make Baldwin an even better source for brass castings of all sizes. Deliveries have been speeded up 220%, castings are more uniform in grain structure and have much better finishes. In addition, casting prices have been lowered as much as 30%.

The lower photo shows two "squeezer" machines that are among the new equipment accounting for faster production and finer quality. Molds all ready for pouring are produced by these squeezers. With the two halves of a pattern mounted on opposite sides of a plate, the complete mold is squeezed in one operation. The operators then lift off the top half, remove the plate, mate the two halves and remove them from the flasks onto the conveyor where the clamping flask and weight are added for pouring.

Note the clean, smooth surfaces of the plug-valve bodies (upper photo) that were molded on the squeezer machines. Baldwin's exceptionally close control of sand mixtures assures *you* such fine finishes that you can count on further savings due to a great reduction in the amount of machining required to produce your finished article.

For further information about the 110 brass and 20 iron alloys that are available in Baldwin castings, write for catalog 6000 to Dept. 5702, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

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business. Is the firm gaining, standing still, or beginning to lose out to competitors?

In my experience I have found that the best way to present these facts to the foremen is in the form of charts, continuous line charts, on good strong paper about 3¾ x 6¾ in. and perforated for a pocket-sized loose-leaf binder. The charts should cover all the important monthly facts that it is desirable to keep each foreman posted on. Each chart should have a proper code number that will locate it in the binder, and, also, it should be dated. The original, of course, should be kept in the office and a couple of prints taken off each one. One of these prints is to be kept by the foreman of the department it belongs to, and the other should be initialed on the back by the foreman under any notes he wants to make. Perhaps he wishes to explain some unexpected dip, or take credit for a rise in the curve. It is best, if possible, to have the charts routed the same way as the production follows, i e, start at the pattern shop and follow through.

It is best always to arrange the curves so a rising line indicates an improvement and a falling line a decline in the company's production efficiency. Foremen, including Al, will have no trouble in determining just how their department is progressing and will get ample warning to look out for high costs or falling off in quality, as well as other important items, and they can govern themselves accordingly.

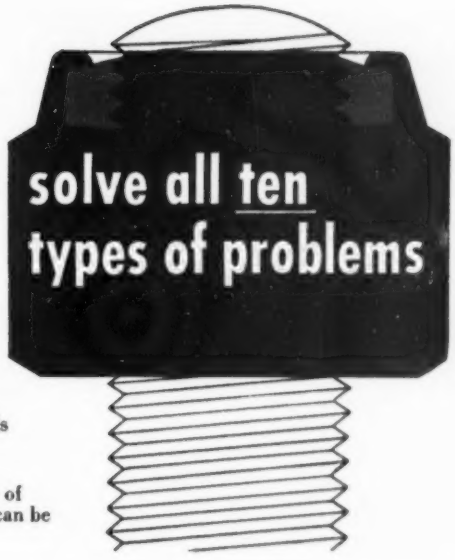
Each department should be given the opportunity to check all other departments and find how they are making out. A foreman should stand or fall by his record in the open, whether he is the son-in-law of the president, one up from the ranks, or an outsider.

The financial department should still keep their tabulations in figures to a fraction of a cent.

George P Pearce
Albuquerque, NM

"If you gentlemen will recall your speeches at the last employee rally—quote, 'Feel free at any time to bring your problems to us' . . ."

elastic stop nuts solve all ten types of problems



Here are ten typical fastening problems. One device, the ELASTIC STOP nut, solves them all—without additional parts or operations. Deliberately undersized in relation to bolt diameter, the red elastic collar grips the bolt with a perfect fit, exerting a continuing self-locking pressure against the threads, and holding the nut securely in place at any point on the bolt. It also provides a tight seal against the bolt threads, which prevents seepage and wear-producing axial play. And because the bolt threads are protected against moisture from without, the nuts are not "frozen" to the bolt by corrosion.

ELASTIC STOP nuts stay tight, right where you put them, in spite of vibration and stress reversals. Yet they are not jammed in place, and can be removed with a wrench and reused many times.

For further information on ESNA self-locking fasteners, mail the coupon below.

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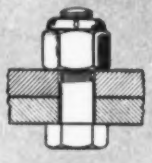

Wherever a vibration or impact proof bolted connection is desired.

On all electrical terminals subjected to vibration in transit or operation.

For uniform and precise prestressing of multiple bolt assemblies . . . adjusted by predetermined wrench torques.

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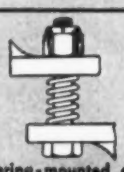
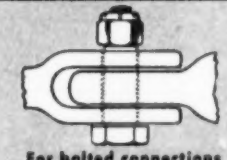


Spring-mounted connections or dynamic balancing, where nut must stay put yet be easily adjusted.

On make-and-break adjustment studs where accurate contact gaps are required.



For bolted connections requiring predetermined play.

For rubber-insulated and cushion mountings where the nut must not work up or down.

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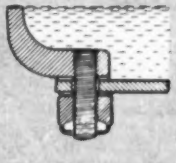

To seal bolt threads where elimination of leakage past stud threads is necessary.

To seal bolt threads where it is necessary to protect them from corroding elements.

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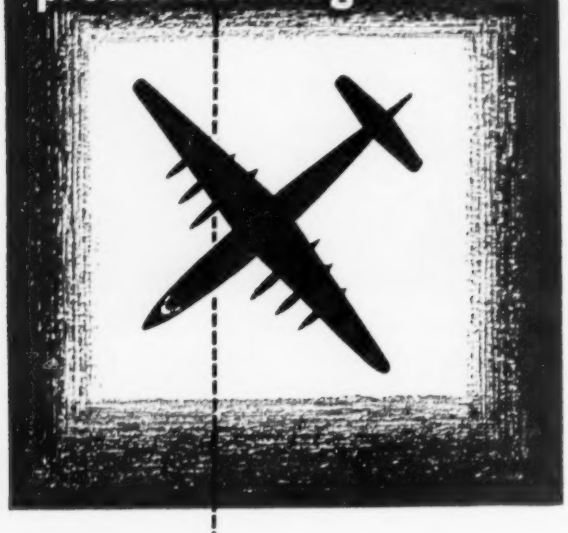

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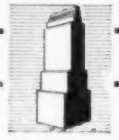

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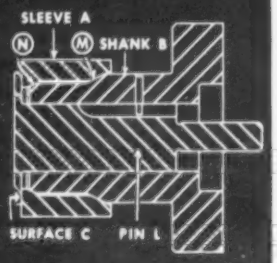

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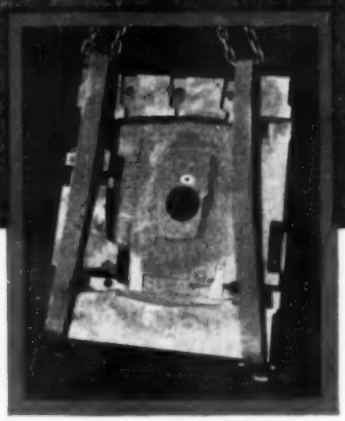

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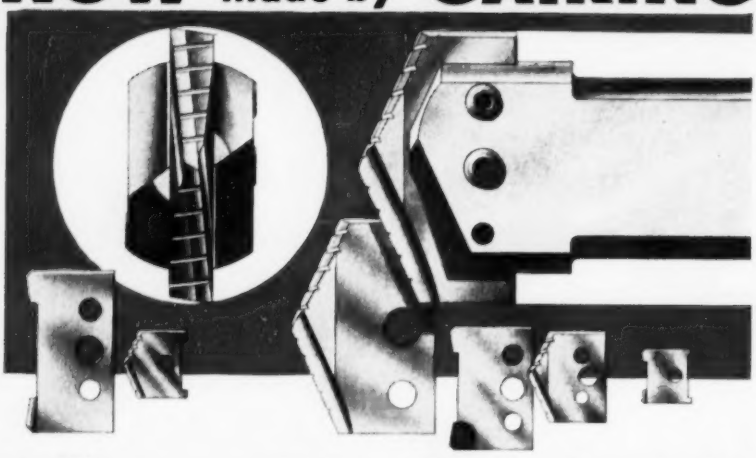

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Mounting production costs are driving firms out of the competitive picture. Too much scrap metal! Too many single operation machines! Too many operators! This whole picture can be changed to a highly profitable operation.

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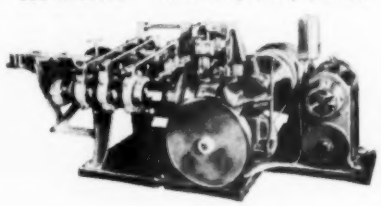

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6 HELPFUL MANUALS

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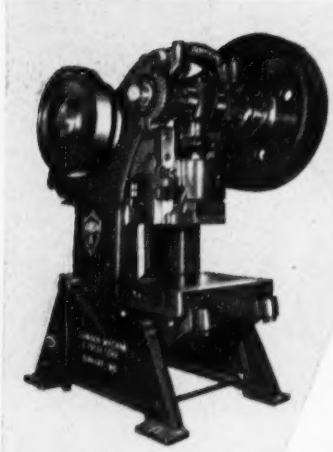

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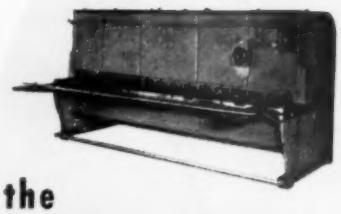

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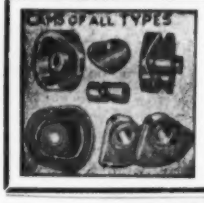

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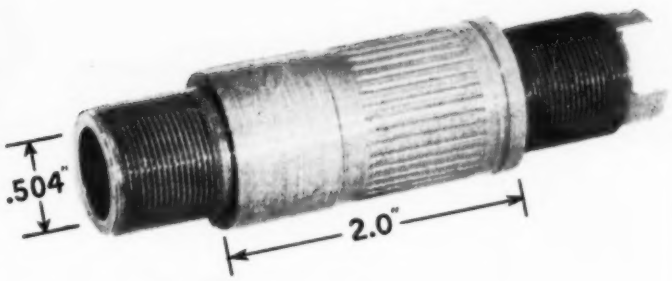

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when prominent manufacturer switched to SUNNEN HONING

PROBLEM: Step up production of high pressure (5000 psi) grease pump cylinder.
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HOLE LENGTH: 2″
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FINISH: 3 micro-inches RMS.
MANUFACTURER: Lincoln Engineering Co., St. Louis.

SOLUTION: Sunnen Model MBB Precision Honing Machine with standard K16 honing unit, using 220 grit alundum abrasive stone and Sunnen MAN-844 Honing Oil. Semi-skilled labor is used.

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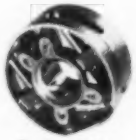
Bronze motor bearing

Steel worm gear

SUNNEN PRODUCTS COMPANY
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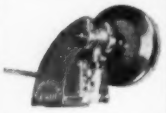

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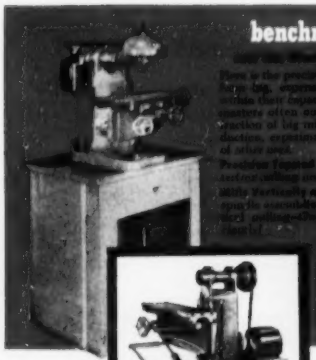

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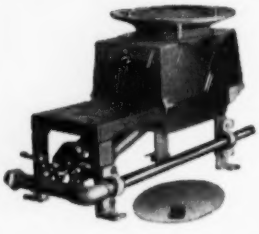

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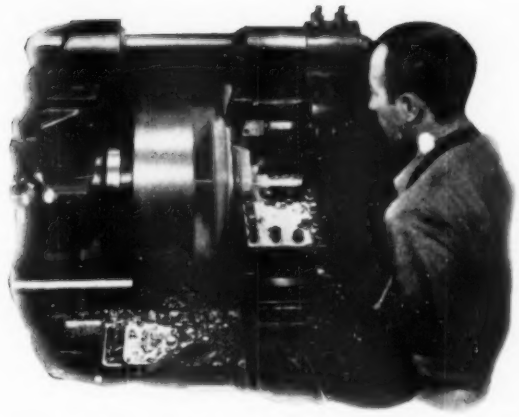

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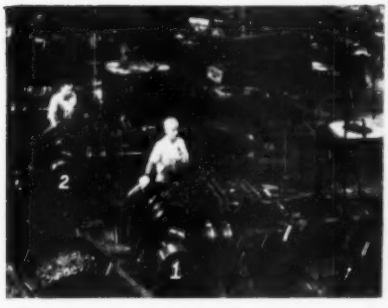

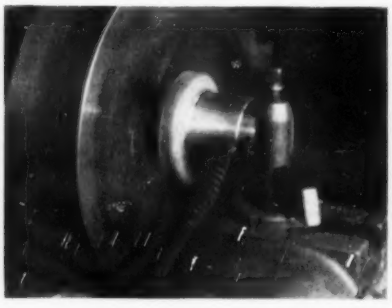

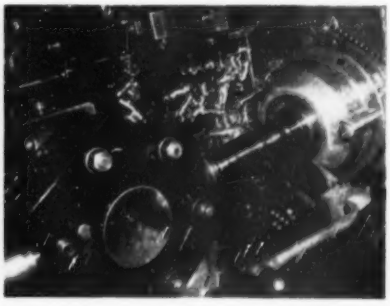

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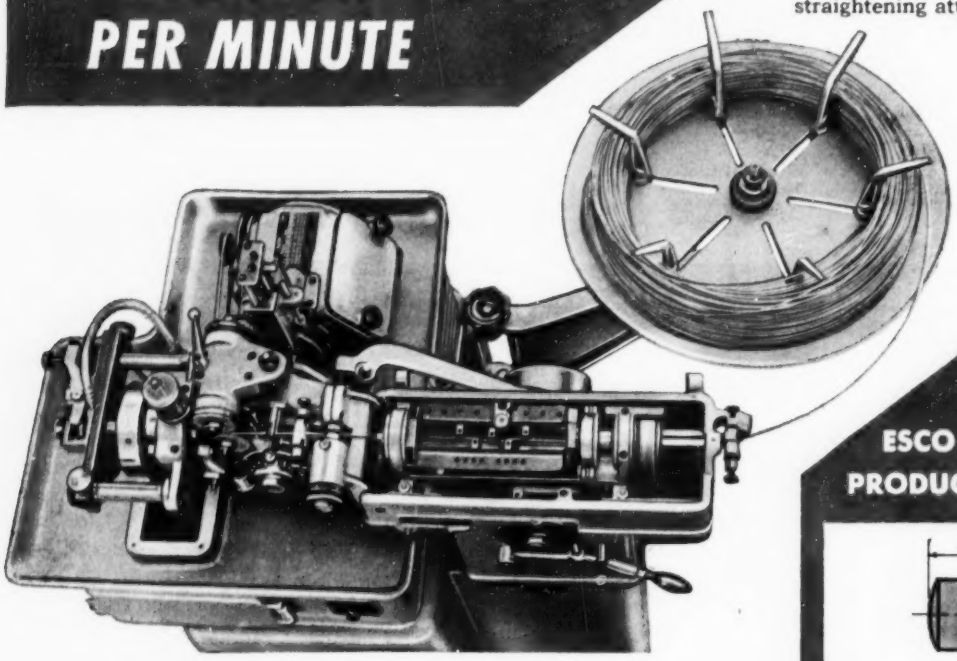
SINCE 1854

GET UP TO 100 SMALL PRECISION PIECES PER MINUTE

Below: ESCO ROTOMATIC DS 1 with optional wire-straightening attachment

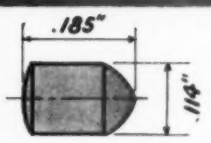


PARTS UP TO 5/32" DIA. X 1" LONG MACHINED AS CLOSE AS ± .00025" FROM COILS OR BARS

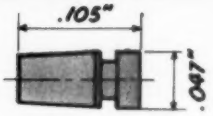
A Swiss automatic form-turning and cut-off machine with optional wire-straightening attachment—you get high-speed production from coils or bars of any length. Coil-feeding speeds and economizes your operation by eliminating bar ends and bar loading time. Machining is done by two cutting tools mounted in a cam controlled tool head. The tool head rotates around material which is fed, guided, and clamped by a collet and a guide bushing. Machined parts are smooth, straight and *entirely burr-free* when they are delivered to the tray *separate from the chips.*

Get more information today about this machine and see how it can boost your production and cut your costs.

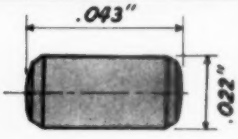
TYPICAL ESCO ROTOMATIC PRODUCTION RATES



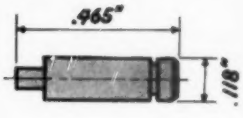
100/min.—brass



63/min.—nickel-silver



50/min.—nickel



10/min.—mild steel

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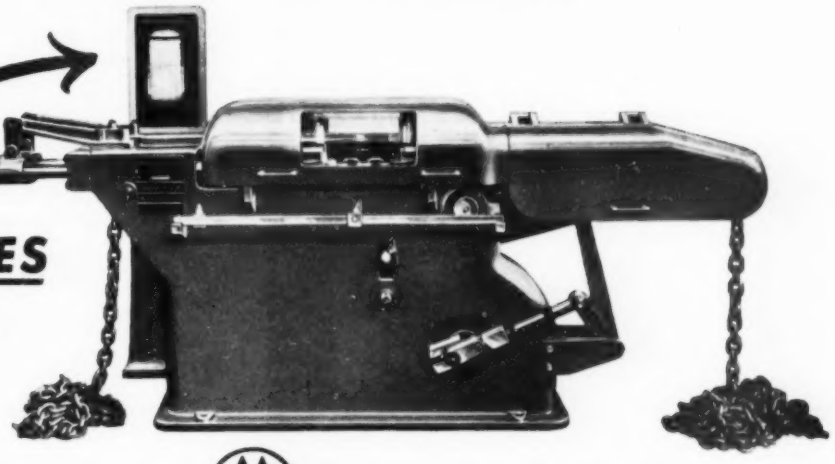
WHOEVER BUYS THIS CHAIN

CAN GET *this* CHART which PROVES the chain is good



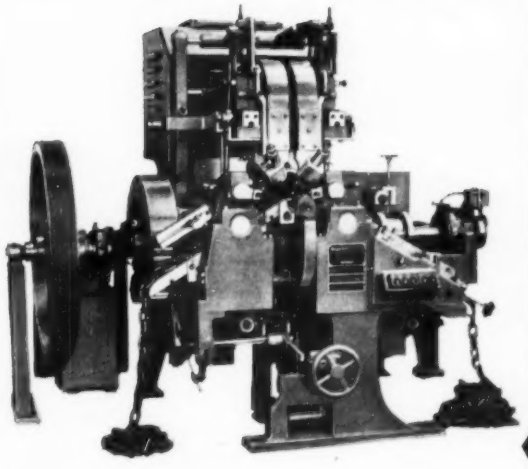
it was tested on a M R+P automatic tester

Meyer, Roth & Pastor chain testers do a more complete and accurate job than ever before. Depending on pitch and wire diameter, lengths of chain from 3 to 13 links can be tested at a time, and up to 45 lengths can be tested in one minute, automatically. Furthermore, for each length which meets tolerances, a continuous-line chart is produced which you can deliver with the chain as proof of thorough testing.

Here's how it works: each section of chain is stretched to a pre-determined length. The chart shows the tensile strain used to stretch each section. Those which stretch to the limit before minimum strain is applied are too weak—those which require strain over maximum have short links which weaken during testing. Both types, including those which break during tests, are rejected, and the machine stops automatically. However, sections which reach full length between mini and maxi strains are passed, and each one has the chart to prove it.

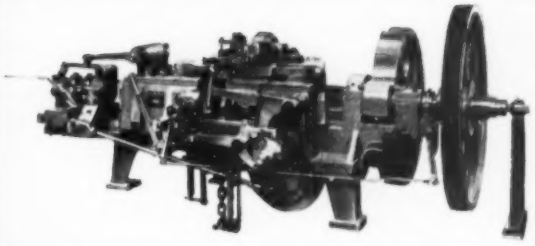
In addition to testing chain and recording results, this machine performs one other important operation: from each test-proved length of chain, one link is automatically stamped, either with your trademark or some other product identification.

AUTOMATIC CHAIN WELDING MACHINES



Automatic, mechanical control during welding provides excellent welds, even on alloy steel. Attachment shaves off burrs around complete diameter of each weld smoothly, automatically. 9 sturdy models. Capacities: wire stock up to 1 1/32" dia. Speeds: up to 85 links/min.

AUTOMATIC CHAIN BENDING MACHINES



Excellent for short or long links. Two-position bending (for wire diameters of ⅜" or more) prolongs tool life and reduces bending marks on links. 7 sturdy models. Capacities: wire stocks up to 1" dia. Speeds: up to 130 links/min.

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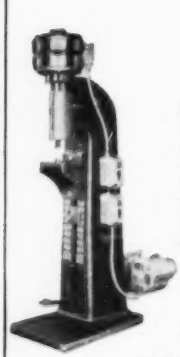

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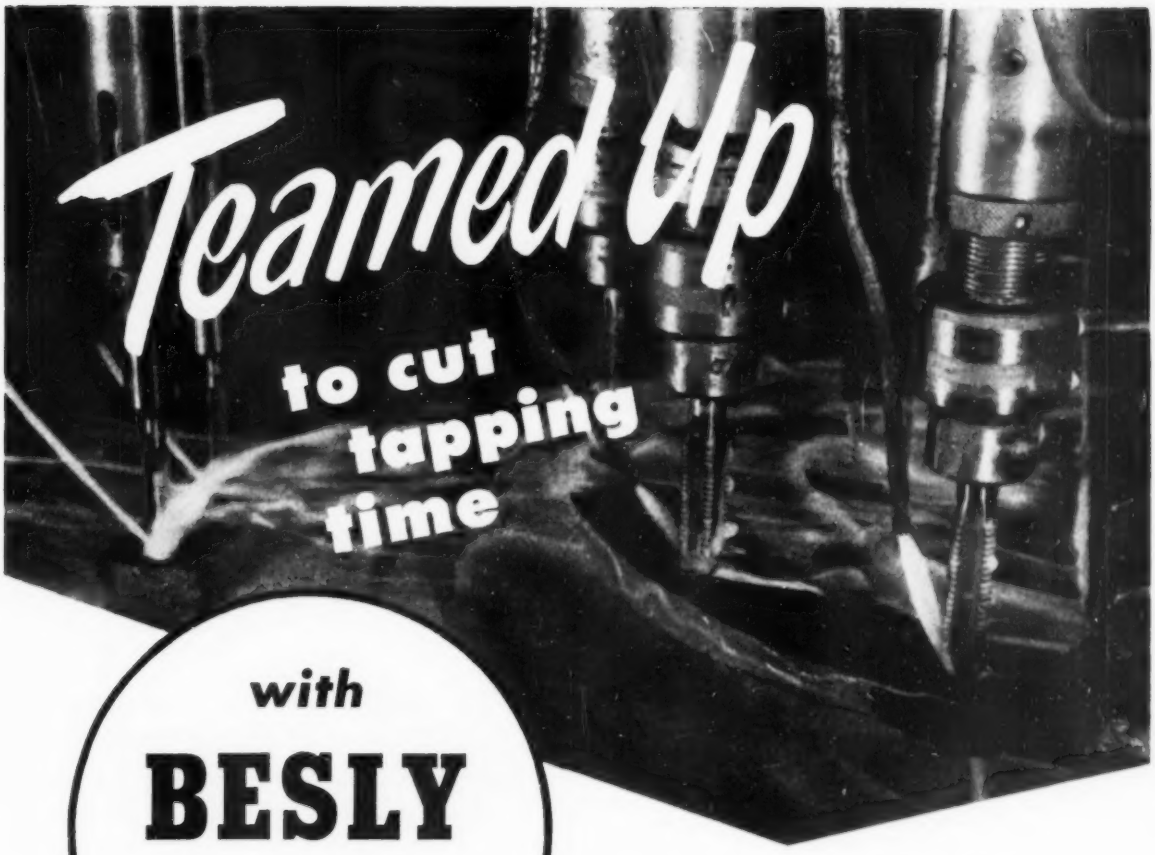

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. . . Besly Taps are used for precision, multiple-tapping operations. For example, on the D8 Tractor cylinder block, a Besly set-up taps 15 holes simultaneously in the fly wheel end.

BESLY TAPS, teamed up with the experience of a BESLY Field Engineer, can give *you* better threads, too . . . with high production and long tap life. Let our engineers prove with a no-cost trial on your toughest job that BESLY gives you more tapped holes . . . better tapped holes per tap dollar. Ask your distributor for proof now.

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This handy HANDBOOK FOR TAP USERS informs you on up-to-date tapping methods and tap selection. *Write for your FREE COPY.*

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Established as Charles H. Besly and Company in 1875
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BESLY Drills, Reamers and End Mills . . . High Speed Cutting Tools in all types and sizes.

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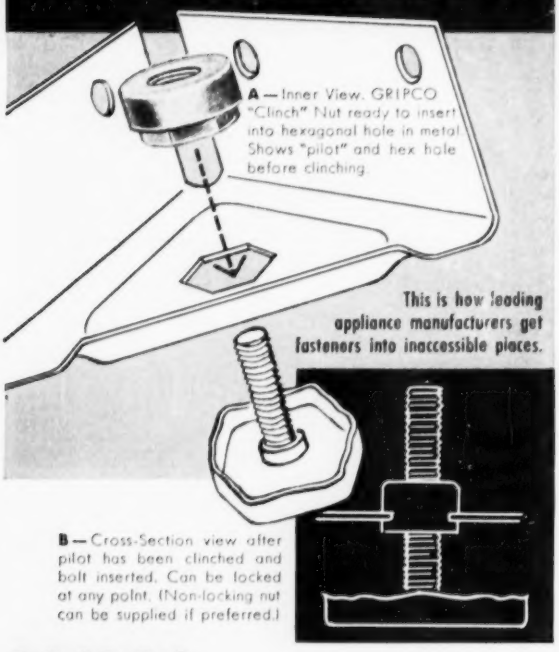


A—Inner View. GRIPCO "Clinch" Nut ready to insert into hexagonal hole in metal. Shows "pilot" and hex hole before clinching.

This is how leading appliance manufacturers get fasteners into inaccessible places.

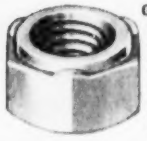
B—Cross-Section view after pilot has been clinched and bolt inserted. Can be locked at any point. (Non-locking nut can be supplied if preferred.)

GRIPCO CLINCH NUTS

The above typical application shows how GRIPCO "Clinch" Nuts are successfully used by famous makers of ranges and other appliances such as washers, dryers, refrigerators, freezers, room air conditioners, etc. In the example illustrated the GRIPCO "Clinch" Nuts serve a dual purpose, first, for crating, holding the product rigid in its container during shipment, with no possibility of bolts "backing out" and allowing the appliance to become damaged while shipping, and second, after installation, for holding the bolts which serve as feet that are adjustable for levelling.

Do you have any application on which fastening must be made from a hard-to-get-at point; or do you need additional threading depth for applying bolts to thin metals? Investigate this method of firmly affixing GRIPCO "Clinch" Nut to the work so it is already in position when bolt is applied.

Where Welding is Available — You may prefer to use



GRIPCO Pilot Projection Weld Nuts Circular pilot accurately positions nut in the bolt hole, for resistance welding. No jigs necessary. Two pilot heights for different gages of metal.

or GRIPCO Countersink Weld Nuts The special countersink feature eliminates the possibility of hot metal particles lodging in the threads, thus no retapping is necessary.

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1—Firmly lock on to bolt at any position.
2—"Stay put" on bolt, in spite of vibration, tension, etc.
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4—Oil or water do not affect Gripco locking action.
5—Can be removed with a wrench and reapplied repeatedly without loss of locking action.
6—Cost less because of simple design.

Write for samples, mentioning types and sizes of nuts you use.

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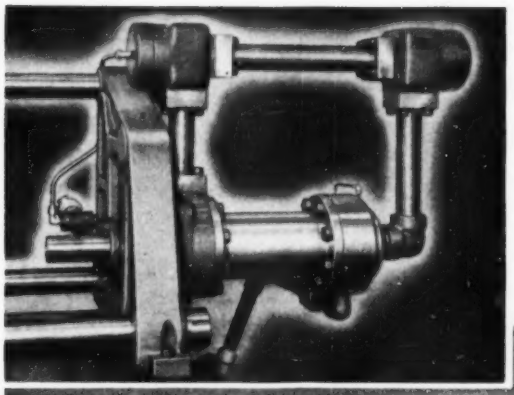

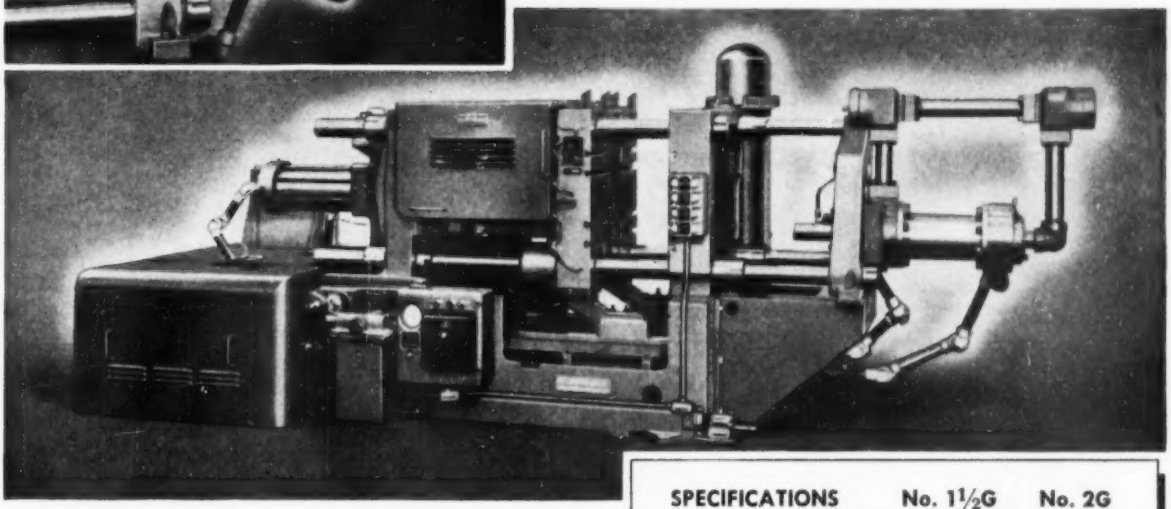

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The "Hi-Speed Hi-Pressure Plunger" attachment can readily be applied to Reed-Prentice No. 1½G and 2G machines now in use and can be furnished as an extra on new 1½G and 2G machines.

SPECIFICATIONS	No. 1½G	No. 2G
Size of die plates	32 x 29"	38 x 36"
Space between tie bars	20 x 15"	23½ x 23½"
Diameter of tie bars	4"	4½"
Die opening	10¼"	14"
Maximum die space	22"	30"
Die locking pressure, tons	250	400
Capacity per shot (Aluminum)	3.75 lbs.	9 lbs.
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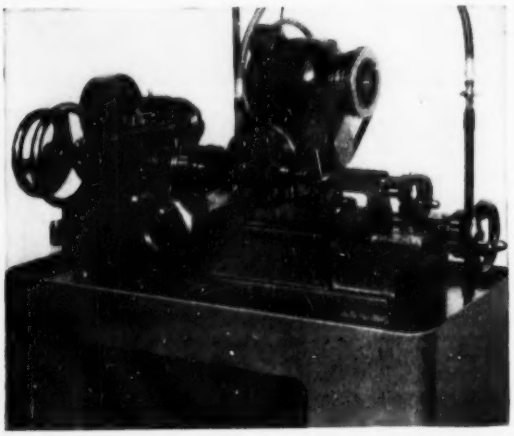

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. . . for producing accurate, fine-finish threads on small diameters at low cost

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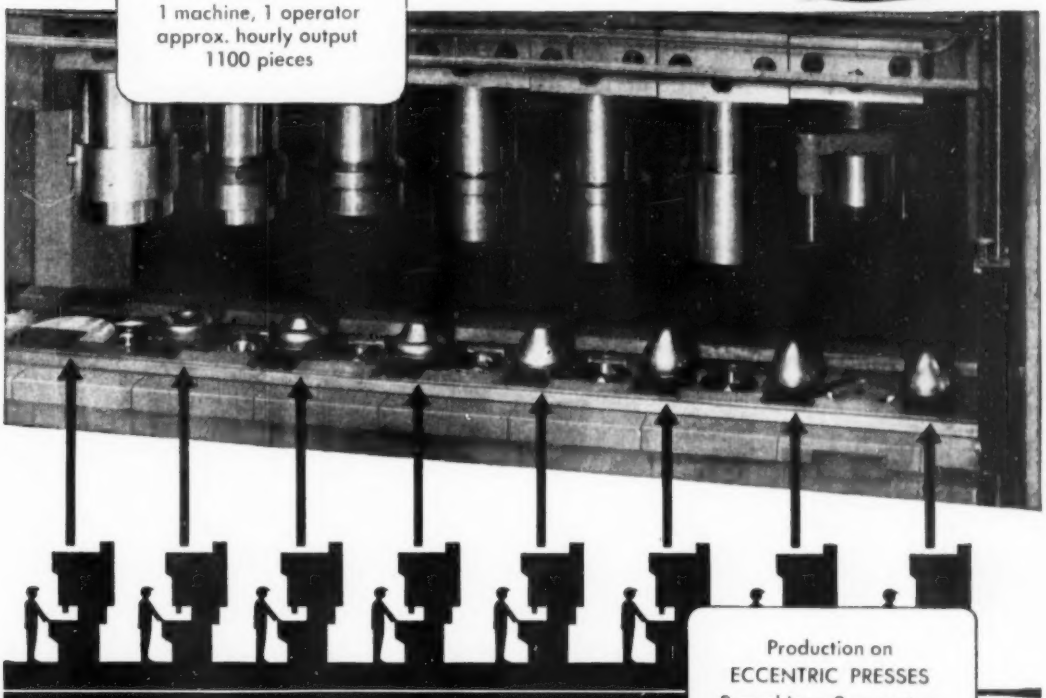
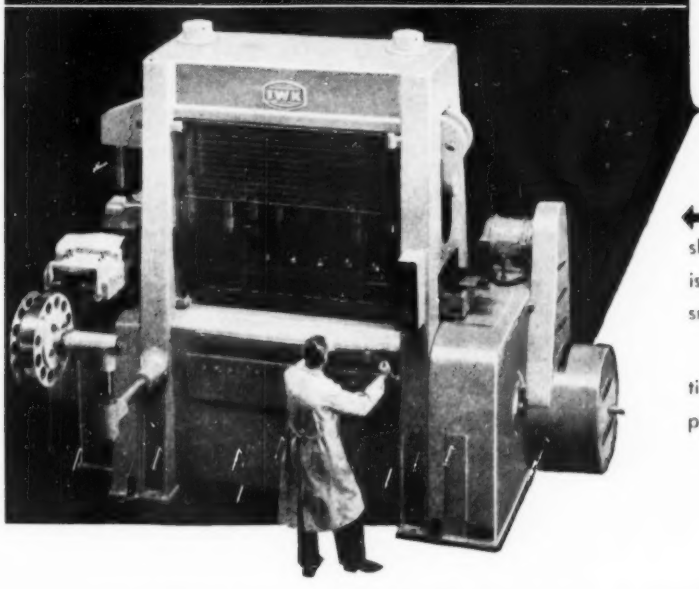
approx. hourly output
1100 pieces

Example: Manufacture of headlight cases (90 mm. in diameter)



Production on
ECCENTRIC PRESSES
8 machines, 8 operators
approx. hourly output
420 pieces



← The IWK stepped press requires only short conversion times for the tools. It is therefore very economical even for small production runs.

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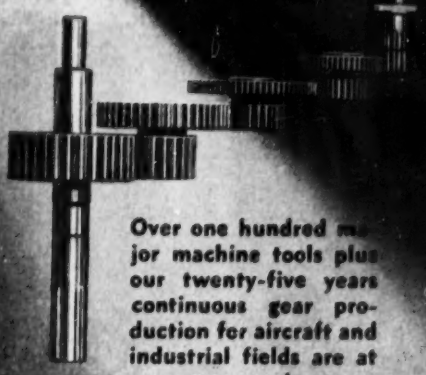

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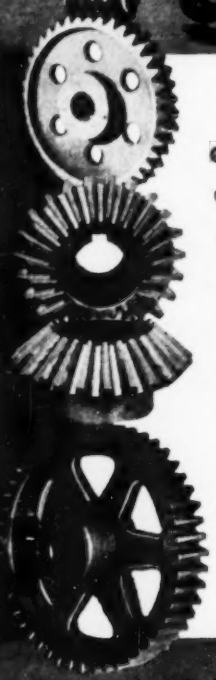

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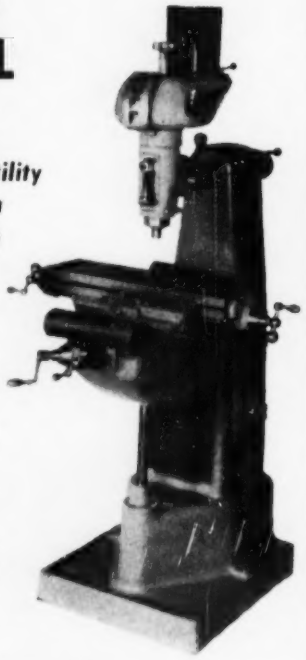

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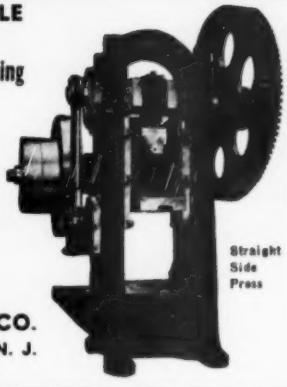

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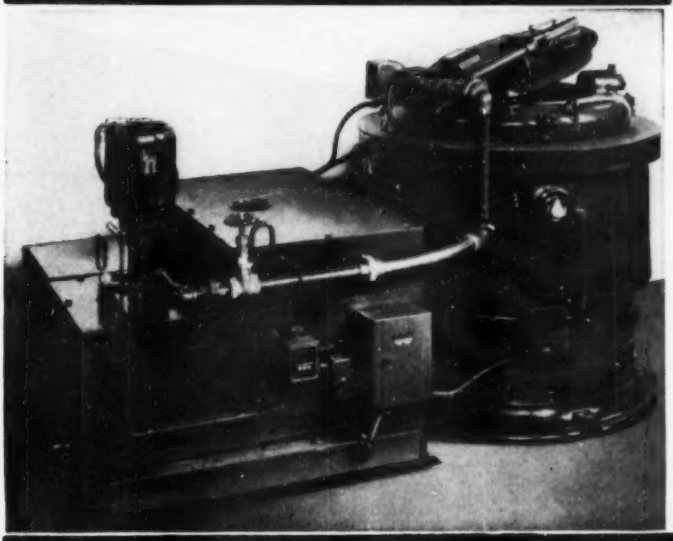

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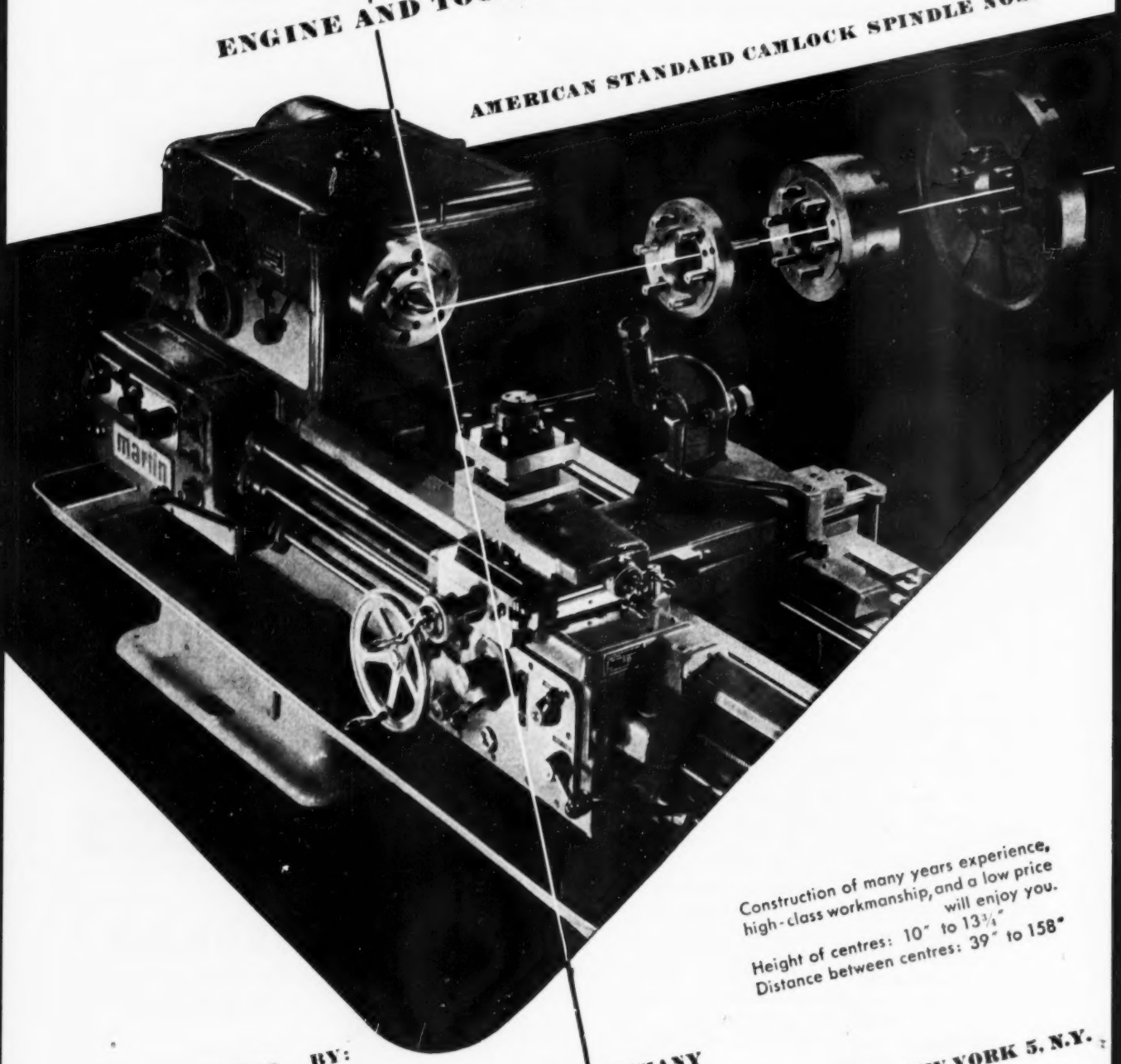

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1 Gould and Eberhardt Hobber 48 inch equipped with differential and preferably with tangential feed. Must be in excellent condition. Write giving serial # age and price.

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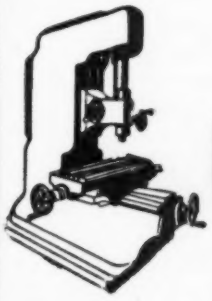

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FINE LATE TYPE GUARANTEED TOOLS

28"x15' centers **BERTRAM** (Niles patterns) "Timesaver" Engine Lathe, 2 carriages, rapid traverse, AC-MD, new 1943.

36"x12' centers **AMERICAN** Heavy Duty 16 Speed Geared Head Lathe, AC—MD

60"x20' **NILES-BEMENT-POND** Geared Head Engine Lathe, rapid traverse.

No. 2 **WARNER & SWASEY** Hand Screw Machine, geared head, power feeds, AC motor in base, Timken spindle.

No. 4L **GISHOLT** Turret Lathe, 1945.

61" **BULLARD** Maxi-Mill, Vertical Boring Mill, 2 swivel heads on rail, power rapid traverse, 20 HP AC motor drive.

42" **BULLARD**, Vertical Boring Mill, extra high column, Serial No. 12938

No. 2 **CINCINNATI** Vertical Mill, dial type, new 1945

No. 3-24 **CINCINNATI** Plain Hydromatic Mill, AC-MD

No. 4 **KEARNEY & TRECKER** Plain Horizontal Mill, No. 50 taper, motor in base, rapid traverse.

No. 4 **CINCINNATI** Hi-Power Vertical Mill, No. 50 taper, power rapid traverse, AC motor

No. 4H **KEARNEY & TRECKER** Vertical Mill, new 1944

5" bar **KEYSTONE** Horizontal Boring Drilling & Milling Machine, floor type, 14' horizontal travel of column on runway, new 1942.

48"x48"x10' **NILES** Double Housing Planer, box table, DC reversing motor drive.

48" widened to 69" x 12' **DETRICK & HARVEY** Double Housing Planer, box table, DC reversing motor drive

No. 2 **BROWN & SHARPE** Surface Grinder, motor inside base, power feeds.

25A **HEALD** Rotary Surface Grinder, 24" diameter magnetic chuck, AC-MD.

14" x 48" **MATTISON** Hydraulic Surface Grinder, magnetic chuck, AC motors, 1940

36" **OHIO** Dreadnaught Shaper, AC-MD.

1½" **LANDIS** Bolt Threader, leadscrews, AC-MD.

30" **MORTON** Hydraulic Keyseater, new 1942

600 Ton **CHAMBERSBURG** Wheel Press, cast steel frame, inclined, AC-MD

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AUTOMATIC, Cleveland Model #B-1½" Sgl. Spdl.
AUTOMATIC, #2 B & S Wire Feed, 1" screw, Cap.
AUTOMATIC, 0G Brown & Sharpe Hi Speed, M.D.

BALANCER, Anderson Bros. 14"x64", Roto-Checker.
BORING MILL, 36" Bullard M.D., V.T.L.
BORING MILL, 2½" Lucas Horiz., M.D.
BORING MILL, Lucas Horiz., 3" Bar, M.D.
BORING MILL, Giddings & L #0 Horiz. 3⅛" Bar.
BORING MILL, 100" Niles B-P M.D. 2 swivel hds.
BARRELS, Tumbling Lupomatic, Schutte & Koerting.
BRAKE, #335 Chicago, M.D., Press, 6' 15 ga., NEW.
BRAKE, #185 Chicago Power Apron, 8'x3/16" cap.
BROACH, LaPointe 5 ton, 36" stroke.

COMPRESSOR, Ingersoll Rand ER-1, 10 HP, M.D.
COMP., 15 HP, 10 HP, Gardner Denver, M.D., New.
COMPRESSOR, C-P 50 HP, M.D., 10x10, 278 CFM.
COMPRESSOR, Ing.-Rand ER-1, 100 HP Syn. M.D.
CRANE, GET Ricker 2 tons 11'9" span.
CRANE, Canton #8 Portable Gooseneck 3 ton cap.
CHIP WRINGER, 20" Tolhurst M.D., Late.

RADIAL DRILL, 3' 9" Mueller, M.D.
RADIAL DRILL, 3'x11" Canedy-Otto, M.D., Late.
RADIAL DRILL, 4'x11" Cincinnati Bickford, M.D.
RADIAL DRILL, 5'13" Cincinnati-Bickford, M.D.
RADIAL DRILL, 6'x15" Cincinnati-Bickford, M.D.
RADIAL DRILL, 30" Walker Turner M.D., Late.
DRILL, Fosdick 16", S.S. Power Feed, M.D.
DRILL, #2 Colburn H.D. #4 M.T., M.D.
DRILL, #121 Baker Auto. S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic #2 M.D.
DRILL, Edlund #2B, 3 spdle. #2 M.T., 16"
DRILL, 4 & 6 Sp. Avey 12" overhang, #3 M.T., M.D.
DRILL, 4 Sp. Barnes H.D., M.D. #4 M.T., P.F.
DRILL, Cincinnati 21" with Tapping Attach. M.D.
DRILL, Natco Multiple Spdle C5, 10 Sp. M.D.
DRILL, Natco Multiple Spdle #12, #1 M.T., M.D.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4
DRILL PRESS, #2MS Buffalo Forge single spindle.
DRILL, Barnes, 24" S.S. #4 M.T., 1¾" cap.
DRILL PRESS, #25 Foote-Burt S.S. 24", #5 M.T.
DRILLS, #14, #15, #16, #18 Buffalo Forge, M.D.
DEEPFREEZE Motor Products 40 below zero.
DEMAGNETIZER, SB-911 Magnaflux, late type.

FACING HEADS, 20" & 24" Mummert-Dixon.
FILER, #11-S Cochrane Bly Auto Saw Filer.
FILER, Type P4 Oliver Floor Type, M.D.
FURNACE, Westinghouse Elec. 18 KW. 2100° F cap.

GRINDER, M.D. Sanford Surf. 4"x12" cap., New.
GRINDER, #1 Wilmarth Morman Hand Surf., 6"x12".
GRINDER, #2 Imperia Univ. Tool & Cutter, New
GRINDER, #2 Brown & Sharpe Bur. 6"x18" cap., M.D.
GRINDER, #4 G & L Univ. Tool & Cutter, M.D.
GRINDER, Disc. Besly #205, 18" Dble End.
GRINDER, Heald Rotary #25, M.D. 16" Cap.
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x60"
GRINDER, Thread, Jones & Lamson #TG-515, Late
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, 14"x36" Pratt & Whitney Vert. Surf.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.
GRINDER, Greenfield #12 Int. Hydromatic, M.D.
GRINDER, Oliver Auto. M.D. Drillpointer, #510.
GRINDER, #33 Abrasive Vert. Auto. Surface, M.D.
GRINDER, #22 Heald Horiz. Rotary Surface, M.D.
GRINDER, Diamond Snagging 10 HP, 24"x4½".
GRINDER, Norton 6x18 Vert. Surface, Hyd. Late
GRINDER, #60 & #70 Heald Internal.
GRINDER, Landis 6"x18" Hyd. Cyl. late type, M.D.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, 37" Wheel Dia. Osterholm Disc, 24" cap.
GRINDER, 30" Ingersoll Tub Face Mill, M.D.
GRINDER, #79, 72" Gardner Vert. Spindle, Late.
GRINDER, #214—30" Besly Double End Disc, Late.
PROFILE GRINDER, Studer Type PSM, M.D., late.
GEAR LAPPER, #8LS, #13LSI Fellows, Outboard Supports, Detachable Laphead, Late.
GEAR SHAPER, Fellows #6 High Speed, M.D.
GEAR SHAPER, Fellows #7 High Speed, M.D.

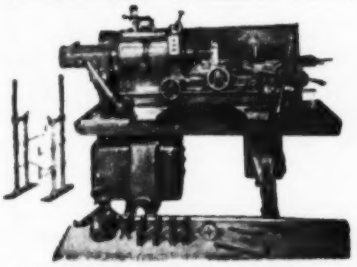
HAMMER, Rochester Hispeed, all sizes, M.D.

4DE POTTER & JOHNSTON Automatic Turret Lathe, Motor Driven, T.E.F.C. 7½ HP. 3/60.220/440.

HAMMER, Bradley 200# Rubber Cushioned Helve
HEADER, Manville #1 S.S.D.D. Cold 3 1/16".
INDUCTION HEATER, 16 KVA Ecco Hi Frequency
INDUCTION HEATER, 30 KW Lepel, Late Type.
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting, NEW
HONE, #194 Barnes Vertical, M.D., Hyd. Late.

KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
LAPPER, 2F Norton Vert., M.D., late type.

No. 7 BARDONS & OLIVER Geared Head
Full Universal Turret Lathe, Preselector Head, Bar Feed, 4" capacity through spindle. Late Type, Motor Driven.

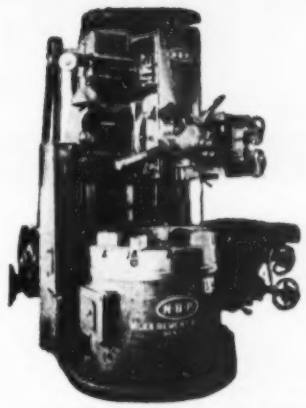


#2 WARNER & SWASEY Geared Head Turret Lathe, 12 Spindle Speeds, Bar Feed.

LATHE, Lo-Swing 8"x108", M.D., A.C. Rebuilt.
LATHE, Porter-Cable 9"x25" Geared Head Prod.
LATHE, #6 WSL Reid Smallpiece Prod., Late Type
LATHE, LeBlond 14"x6', Q.C.G. M.D.
LATHE, Hendey 14"x8' Q.C.G. Taper Attach. M.D.
LATHE, American 16"x6' Q.C.G., Grd. Hd. M.D.
LATHE, Lehman 18"x7' Q.C.G., M.D.
LATHE, American 18"x10' Q.C.G., Grd. Hd.
LATHE, South Bend 18/28"x8' Gap Bed, Q.C.G. M.D.
LATHE, Reed-Prentice 20"x10' Grd. Hd. M.D.
LATHE, LeBlond 22"x10' Q.C.G., M.D.
LATHE, 24"x10' Axelson Grd., Late, M.D.
LATHE, 24"x12' Boye & Emmes Grd. Hd., T.A., Late
LATHE, Putnam 23/32"x12' Q.C.G., M.D.
LATHE, LeBlond 24"x14' Q.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', Q.C.G., M.D.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, 27"x16' Niles Timesaver, Grd. Hd., M.D.
LATHE, Bridgeford 32"x16' Q.C.G., Grd. Hd.
LATHE, 42"x18' Pittsburgh Geared Head, M.D.
LATHE, Bullng Dble. End #VMT5, Devine Bros.
LATHE, Turret #1 Bardons & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret #2 W & S Univ. Grd. Hd., Late.
LATHE, Turret, #4 Warner & Swasey Univ. 1½"
LATHE, Turret #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #2 Cinci. Acme Univ. Geared Head
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
LIFT TRUCKS, 1 & 2 ton, Platform & Fork.

MILL, No. 1 U. S. Hand Mill, M.D. Late.
MILL, #4 Burke Motor Driven, Late, M.D.
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, 2M Cincinnati Univ. Horiz. M.D.
MILL, #3B Brown & Sharpe Vertical, M.D.
MILL, #3VB Hardinge Vert. Bench, M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #14 Garvin Plain Horiz., M.D.
MILL, #0Y Brown & Sharpe Plain Horiz., M.D.
MILLING MACHINE, #2B K & T Horiz., M.D.
MILL, Cinci. Horiz. #3, #4, #5 High Power, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #6-8 Cinci. Vert. Prod. Late, M.D.
MULT-MILLER, U.S. Tool #MM-1-6 Auto. Prod.
MILL, #0 Douglas Plain Horiz. M.D., Coolant.
MILL, #0 Sundstrand Rigidmil Hyd. Late Type Vert. Hd.
MILL, #0 Vernon Hand Mill, M.D., Late.
MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILL, #3 Cinc. Univ. Horiz., M.D.
MILLING MACHINE, LeBlond #4 Horiz. Univ.
MILL, #2 Vert. M.D. Brown & Sharpe
MILL, #3 Cinci. Vertical Hi Power, M.D.
MILL, #5C Becker Vert. Die Sinker, M.D.
MILL, 42"x36"x12' Ingersoll Planer Type, 4 hds.
MILLING MACHINE, #2 Van Norman Duplex, M.D.
MOTOR GENERATOR SET, Gen. Electric, 100 K.W.
NIBBLER, #136 Savage 36"x3/16" Cap., M.D.
NAILING MACHINE, No. 16—48"-54" Morgan, Late.

THREADING, Staybolt Lassiter Millholland 1½"
THREAD MILL, 7½x11 Hanson-Whitney, Univ.
THREAD MILL, 6x14 Pratt & Whitney No. 1105
THREAD MILLER, Plan-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late



36" x 44" Niles Vertical Boring Mill, Side Head, Motor Driven.

#40A Lees-Bradner Automatic Chucking Thread Mill, Motor Driven, Late Type.

PAPER SHREDDER, No. 10 Mitts & Merrill, M.D.
PLANER, Cincinnati 30"x30"x12' A.C., M.D.
POWER PRESS, Bliss #164 Open Back, M.D.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 36"x26" Bed Area, M.D.
POWER PRESS—Bliss-Consolidated #163-B Straight Side Dble. Crank 45 tons, M.D.
PRESS, D72 & DG73 Ferracute, Redraw, M.D.
PRESS, #2½ & #6 Toledo, OBI, Motor Driven.
PRESS, #5 Johnson OBI, 56 tons, new.
PRESS, #7 & #8 Johnson OBI 70 & 90 tons, New.
PRESS, 135 Ton Clearing Single Crank 8" Str., Late.
PRESS, 70H & 125PA Drake Hyd. Arbor, New.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS, Waterbury-Farrel High Speed 60 tons #3W.
PRESS, 68 C Bliss Double Action, 3 crank.
PRESS, Lucas 15 tons Power Arbor, M.D.
PRESS, #68 Whitney Deep Thr. 24", foot.
PRESS, P2, P3 Ferracute M.D. Roll feed.
WHEEL PRESS, 600 ton Niles Cement Pond, A.C.
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, #46 Buffalo Forge Vert. Cap. 1"x1½" M.D.
PUNCH, H-4 Wiedemann Turret, 10 Stat. 24" thr.
PUNCH, Hecker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 Sgle. End, 24" Thr. ½" thru 1".
PUNCH, H & J #4, 48" thr., with Shear Blades.

RIVET SETTER, ⅜" cap. Pens. Tubular Rivet.
ROLLS, Bertsch Pyramid 18"x1⅜" cap., M.D., Late.
ROLLS, #1 Buffalo Forge Wrapping, M.D.
ROLLS, 72"x1¼" Lown Initial M.D., New.
ROLLS, #2 Buffalo Forge Vert. Angle, Bending, New.

COLD SAW, Wagner 10"x10" cap., M.D.
COLD SAW, Espen-Lucas #700, 48" dia. blade, M.D.
CUT-OFF SAW, Radiac "J" DeSanno.
CUT-OFF SAW, Yates-American #M-90, M.D.
SAW, #4B Marvel Hack Saw 6"x6" Cap., M.D.
SAW, #20-C Racine Shear Cut 6"x6" cap., M.D.
SAW, 10"x10" Racine Hydraulic, Late Type, M.D.
SAW, Band Tannewitz GH-36" High Speed, M.D.
SHAPER, 16" Pratt & Whitney Crank, M.D.
SHAPER, 20" Rockford Univ. M.D., Tilting Table.
SHAPER, G & E 24", high duty, back geared, M.D.
SHAPER, 32" Cinci., B.G., Motor Driven, M.D.
SHAPER, Morton, 36" Draw-Cut, 4 speed M.D.
SHEAR, 6' x 14 ga. Parker M.D., Late Type.
SHEAR, #26 Buffalo Forge Slitting Armor Plate.
SHEAR, Quickwork #11 Rotary 60" Throat, 10 ga.
SCREW SLOTTER, #2 Waterbury Farrel Auto.
SLOTTER, 12" New Haven Vertical M.D.
SPOTTER & SCRAPER, Anderson Power Unit, Late.
SPRU CUTTER, Milwaukee 56 tons, 2½ cap., M.D.
SURFACE PLATES & TABLES, all sizes.
TAPPER, #1 Cam Haskins, Motor Driven, Late.
TAPPER, #1 Bakewell (Warner & Swasey) Late.
TRUCK, 2000 lbs. Hyster Fork Lift 9' Model GT-20.
TRUCK, 4000 lbs. LT-44 Towmotor Fork, Lift 9'.
BRINELL TESTER MACHINE, Type UK300M.
BRINELL TESTER, Type 03DR, Steel City.
WELDER, 500 amp. Westinghouse Flexors A.C.
WELDER, 200 & 400 amps. Gen. Elec. Portable Arc.
WELDER, 75 KVA Federal M.D., Spot.
WIRE STITCHER, Morrison & Acme, M.D.

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Greenley, 3 way special, (two)
20" Hammond sensitive drilling and tapping machine
Model D6 Natco multiple spindle tapper

BROACHES

5 ton, 40" Foote Burt duplex surface
10 ton, 56", No. 3XA Oilgear
12 ton, No. V2 American vertical
15 ton 36" Colonial vertical surface
15 ton, 48", No. H10 48 American
18 ton, 42" No. V12 American

MILLERS

No. 1 Milwaukee vertical, all geared, friction clutch
No. 2B Milwaukee universal, double overarm, power rapid traverse
No. 2 Cincinnati high speed dial type plain, motor in base, 6 way rapid traverse
No. 3K Kearney & Trecker vert., 1943 high speed dial type
No. 3K Kearney & Trecker univ., high speed dial type
No. 36 Van Norman, ram type, 1943, high speed dial type
No. 436 Cincinnati Hydromatic
No. 448 Cincinnati Hydromatic duplex

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Type A & No. 12 Barber Colman
Nos. 1 & 5A Lees Bradner
No. 12H Gould & Eberhardt
16" Cincinnati hobber
24", No. 3 Farwell hobber
No. 130 Cleveland Rigidhobber
72" Schuchardt & Shutte hob
4" Gleason spiral bevel
No. 13 Gleason gear tester
10" Pratt & Whitney gear grinder
8" & 12" Red Ring gear shavers
24"x12" Flather auto. spur
Cimatool tooth rounders

GRINDERS

No. 2 Cinni. centerless, pressure, lubrication
10"x18" Cincinnati Filmatic bearing type ER plain, cylindrical, New 1941 and 1942
10x18 Norton type BA plunge cut
10x36" Norton type B. semi-automatic hydraulic infeed, cylindrical
12"x48" Cincinnati E.R. Universal, Filmatic
20" No. 120A Gardner disc, new in 1947, double spindle
No. 5 Bryant internal, new in 1945
No. 72A3 Heald plain Sizematic & Gagematic
Nos. 16A, 1628 and 2436, Bryant
24" No. 25A Heald rotary surface, new in 1940
6"x18" No. 2 B&S Surface, 1942
8"x24" No. 5B B&S, late model, surface
12"x48" No. 300 Hanchett Vert. Spindle Surface, 1942

MONEY BACK GUARANTEE

LATHES

14"x42" Hendey 12 speed toolroom, Motor-in-Base, Late.
24"x14 ft. bed American geared head quick change gears
20"x25" Fay automatic, 1942
12"x24" Lithe Carbo-lathes, late type, 3
2—No. 6 R. K. LeBlond multi-cut manufacturing, 1941
No. 3A Warner & Swasey, serial No. 502273, new in 1943, rapid traverse, Timken bearings, long bed
No. 6 Warner & Swasey geared head motor in base
36" Rogers vertical turret, new in 1942, power rapid traverse
36" Bullard, New Era, rapid traverse, rebuilt

MISCELLANEOUS

AIR COMPRESSOR. 194 CFM Ingersoll
PAPER SHREDDER. M & M "Air Fluff"
OIL EXTRACTOR. No. 501 Barrett
ROD POINTER. Type KR Economy Aut.
BORING MILL 3½" Cinni-Gilbert, Fl. Type, 1942
BORING MILL. 4" D. & H. floor type
BORING MILL. 72" N.B.P. vertical
COMPARATOR. 20" Portman
HONES. Nos. 172 & 2610 Barnes
KEYSEATERS. No. 4 Mitts & Merrill
PLANER. 30"x30"x10' Cincinnati
PLANER. 36"x36"x10' Niles Bement Pond
SWAGER. No. 4 Torrington

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Bullard Model D 16-23" Multi-Au-Matic—8 Spindles — Single indexing — MD — Late type

TURRET LATHES

Gisholt No. 3R — Hole thru spindle 6½" — Threading attch—Arranged for bar & chucking—Two-speed MD

Gisholt No. 4 & No. 5 Ram Type Universal—Cap. 2" and 2½" round—Swing 18½" and 19¾"—Arranged for chucking—MD—Late type

Gisholt No. 5 Preselector Head Universal Ram Type—Cap. 2½ round—MD—Late type

UNIVERSAL MILLERS

(NEW) Victoria Model U2R—Range 38"x10½"x16½"—Table 12¼"x50"—MD

Milwaukee No. 3H — Range 34"x12"x17" Table 64"x13½"—Dividing head—MD—Late type

Brown & Sharpe No. 3A—Range 34"x12"x19" Double overarm — Power rapid traverse — Dividing head—MD

MISCELLANEOUS

(2) Pratt & Whitney Model BL2416 Keller Duplicators—One 3-spindle, 3 dimensional and one single spindle, 2 dimensional—Both late type and complete with equipment and controls

(2) Fellows No. 18 Gear Finishers—Will shave up to 22"—One with electrical and one with mechanical crowning attachment—MD

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LATE MODEL TOOLS

Model B3B Natco 24 spindle Multiple Drill, adjustable arms, #2 taper, 1944.

#72-A Heald Tool Room Plain Internal Grinder, T-base, cross-sliding head, 30" swing.

Natco 3-way Horizontal Drill, with hydraulic cycle

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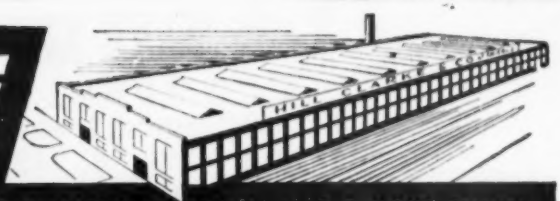

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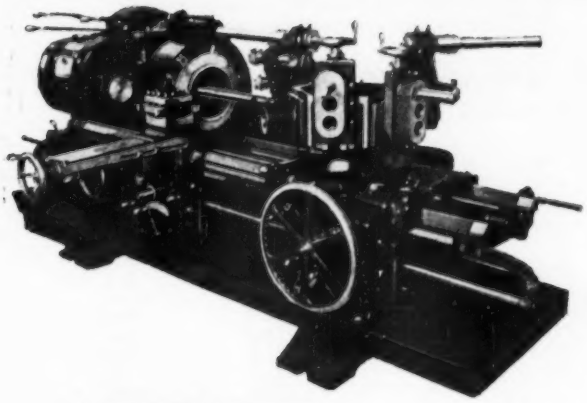

4-A WARNER & SWASEY
UNIVERSAL TURRET LATHE
7½" Hole Through Spindle
Price: $6750

AUTOMATIC

1-1/16" Model A Cleveland (1942)

DRILLS

1 Spdl.—14" Sw.—No. 2 Avey Cam Fd.
1 Spdl.—30" Sw.—No. 4 taper Aurora
2 Spdl.—24/Sw—No. 3 Avey
12 Spdl. D-31 Fox, No. 2 Taper

GEAR MACHINES

No. 12HS Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl, Rougher
No. 612-A Fellows Gear Shaper
No. 615-A Fellows Gear Shaper
No. 65 Fellows—Cone Dr.
8" cap Red Ring Gear Lapper

GRINDERS

6" x 18" Landis (1942)
6" x 18" Norton Cylindrical (1943)
6" x 32" Hill-Clarke (Norton type) Grdr.
10" x 36" Norton Type C
10" x 36" Norton Type C Cam. Grdr.
10" x 48" Norton type C (1943)
Hill-Clarke Cylindrical Grinders
10" x 36" centers
10" x 72" centers
18" x 96" centers
24 x 32 Gap x 144" centers
14" x 36" centers
14" x 72" centers
14" x 96" centers
18" x 96" centers
24" x 264" centers
No. A-3—12" Arter Rotary Surf.
No. 1109 Bryant Internal Grd. (1951) (9" swing — 1" bore x 3½" grind stroke)
No. 5 Bryant Internal Grd.
No. 5B Bryant Internal Grd.
No. 16-16 Bryant Internal Grd.
No. 16-A-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 16 A-28 Bryant Internal Grd.
No. 16 F-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 24-36 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 74 Heald Internal Centerless

Your Worn Machines Can Be "NEW" AGAIN

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HILL-CLARKE
Gives You the Finest Re-manufacturing Obtainable

•

CONSULT US ABOUT REBUILDING YOUR OWN MACHINES

BORING MACHINES

No. 45—4½" Giddings & Lewis Hor. Bar
100" Niles-B-Pond Vert. Bar

LATHES

16" x 33" R-14 Seneca Falls Auto. Lathe
18" x 6' American Geared Head Lathe
18" x 8' Lodge and Shipley
19" x 8' LeBlond Hvy. Duty Lathe
27" x 12' American Geared Hd. Lathe
27" x 12' centers LeBlond Lathe
36" x 18' Putnam Grd. Hd. M.D.
5W Acme Ram type Tur., 2" Capacity
No. 6 Warner & Swasey Tur.-Bar Fd.
18" Libby Tur. Lathe, M.D.
No. 3AL Gisholt Cross-Slide Tur.
No. 4A Warner & Swasey—7½" Hole Spdl.

MILLING MACHINES

No. 08 Cincinnati Vert. Mill (1942)
54" x 30" x 16' Ingersoll Slab Mill
6" x 168" Pratt & Whitney Thrd. Mill
10" x 48" Hanson-Whitney (1942)
10" x 60" Pratt & Whitney Thrd. Mill
12" x 102" Lees-Bradner Thrd. Mill

PLANERS

36" x 36" x 12' Cincinnati, 2 hds.
48" x 36" x 14' Gray, 2 hds.
48" x 48" x 12' Cincinnati, 2 hds.
60" x 48" x 27' American, 4 hds.

MISCELLANEOUS

1"-2" Dia. Cap. Micro. Hor. Hone—#200
¼"-1" Dia. Cap. Micro. Hor. Hone—#H-2
42#—18 gage Economy Power Shear
75 Ton R & K Straight Side Press
3 Ton Fox Hydraulic Press
2—12" x 96" Magnetic Chucks
20' x 1" cap Southwark Roll
15# Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)

FULL MONEY-BACK GUARANTEE

1. Hill-Clarke always give you an unconditional money-back guarantee.
2. All machines in stock.
3. You can see your machine run and tested under power in our plant before purchasing.
4. Complete and modern facilities plus experienced craftsmen for REMANUFACTURING machine tools in our 58,000 sq. ft. plant.
5. A responsible organization — established 1867.

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651 WASHINGTON BOULEVARD, CHICAGO 6, ILL. PHONE CEntral 6-0300

• LATHE CHUCKS •

• COMPARE THESE PRICES •

ACT QUICKLY WHILE OUR STOCK LASTS

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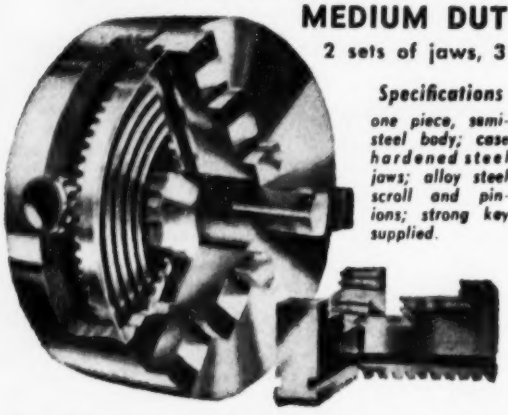
• RUGGED CONSTRUCTION

IMMEDIATE DELIVERY FROM STOCK

These lathe chucks, manufactured in England are equivalent in all respects to chucks selling here for two and three times the price. All are absolutely guaranteed with respect to accuracy, workmanship, and strength.



MEDIUM DUTY 3 JAW UNIVERSAL CHUCKS

2 sets of jaws, 3 pinions, for use with intermediate backplate.

Specifications

one piece, semi-steel body; case hardened steel jaws; alloy steel scroll and pinions; strong key supplied.

Size	Weight	Price	Price Soft Jaws
2¾"	2½ lbs.	$ 25.00	$ 5.00
3¼"	3½	26.50	6.50
4"	6½	30.00	7.50
5"	12	37.50	9.00
6"	17½	45.00	10.00
7½"	29	57.50	13.50
9"	42	67.50	15.00
10½"	62	95.00	20.00
12"	88	125.00	22.50
15"	143	175.00	25.00
18"	200	250.00	35.00
24"	324	325.00	45.00

Steel body chucks are also available in some sizes.
Soft jaws and spare parts are immediately available from New York stock.

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DEWITT EQUIPMENT CO. 136 LAFAYETTE ST., NEW YORK 13, N. Y. WALKER 5-5090

Let *Mac Dell* Help You . . . . If-

immediate expansion is your problem; especially where DELIVERY and ECONOMY are important factors. Every one of our machines is unconditionally guaranteed and practically any machine can be inspected—under power.

AUTOMATICS

NEW BRITAIN model 61 2¼" 6 spindle threading, tooling, 1947.
NEW BRITAIN model 60 1" 6 spindle threading tooling, 1942.

BALANCERS

GISHOLT 12E Static, 1948.

BENDING ROLLS

SOUTHWARK 20'x1" Pyramid Type, Drop End, Balance Bar.

BORING MACHINES

HEALD #49 Double End Bore-Matic, 1942.
EXCELLO 1212 Double End, 1935.

DRILLS

Avey 6-Spindle No. 2MA6 Power Feed, No 2 MT, 12" Overhang, 1943.

GEAR EQUIPMENT

BARBER-COLEMAN Model A Gear Hobber, 1943
FELLOWS 61A Gear Shaper, 1941.
PRATT & WHITNEY 10" Hydraulic, 2 Wheel Gear Grinders (2), 1941.

GRINDERS, CYLINDRICAL

NORTON 10"x18" Type C Hydraulic, 1942
BROWN & SHARPE No. 5 3"x18" Plain with Plunge Grinding, 1943.
BROWN & SHARPE No. 5 3"x12" Plain with Plunge Grinding, 1941.

GRINDERS, MISC.

HEALD No. 72A3 Plain Cross Sliding Head, Riser Blocks, Cam Attach., 1941.
HEALD No. 25A 16" Rotary Surface, 1942.
THOMPSON model B 8"x24" chuck coolant, 1942.

LATHES, AUTOMATIC & PRODUCTION

LODGE & SHIPLEY 3A Duomatic, 1946.
SENECA FALLS Model R-14 Le-Swing, 1942.
SENECA FALLS Model LR Le-Swing, complete, 1942.

LATHES, ENGINE

NILES 30"x144" centers, Timesaver T.A. Chuck, 1941.

LATHES, TURRET

GISHOLT 1L Saddle Type Bar and Chuck, 1944.
GISHOLT No. 3 ram type universal bar and chuck, 1942.

MILLS

CINCINNATI 56-90 Plain Hydromatic.
KEARNEY & TRECKER 2K Vertical, 1943.
CINCINNATI 2-24 Rise and Fall, 1942.
CINCINNATI 1-18 Plain Automatic, "CLIMB" Milling Auto. Spdle. Stop, 1941.
SUNDSTRAND No. 0 Rigidmill 18" table travel. Electronic close stop and dwell, 1943.
KEARNEY & TRECKER Model 1H—18" Manufacturing Mill, 1941.
U. S. MULTI-MILLER MM-1-60, 1944.

MULT-AU-MATICS

BULLARD 12" 8-Spindle, Type D, with Power Chuck and Tooling, 1941.

. . . TELEPHONE MOnroe 6-7715 . . .

Mac Dell **CORPORATION**
1042 W. LAKE ST. • CHICAGO 7, ILL.

1941-1953 MACHINE TOOLS

IMMEDIATE DELIVERY — NO PRIORITIES NEEDED

CAM MILLERS
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CENTERING MACHINES
SUNDSTRAND: 44" Double End Centering Machine

CUTTER & TOOL GRINDERS
FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New) automatic indexing

DRILLING MACHINES
ALLEN: #2 High Speed, 15" overhang
PRATT & WHITNEY: ½B x 50 Deep Hole Drilling & Reaming Machine, 2-spindle
SUNDSTRAND: 44" Double End Centering Machine

GEAR CUTTING MACHINES
BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
CLEVELAND: Model 130 Gear Hobber (like new)
CLEVELAND: Model 140 Gear Hobber (like new)
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Snur Gears and Splines
INTERNAL GEAR GRINDER, GG-31

GEAR FINISHERS & TESTERS
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 4 and No. 6 Bevel Gear Testers. Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GRINDERS—CYLINDRICAL
BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 10"x18" 45° angle wheel

3-WAY GUARANTEE
1. Should any machinery purchased from us prove unsatisfactory, you can return the machines within 30 days, via freight prepaid to our plant, and a full refund will be made.
2. Machines at our plant can be demonstrated and tested under power before purchasing.
3. You are dealing with a well-established, highly-rated firm of machinery engineers with over 33 years of proven responsibility.

GRINDERS—GEAR & SPLINE
GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
INTERNAL GEAR GRINDER, GG-31

GRINDERS—INTERNAL
BRYANT, 16-16 Internal Hydraulic
BRYANT: No. 5Y Internal
HEALD: 72A3 Sizematic Centerless

GRINDERS—RADIUS
VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—SURFACE
THOMPSON: Hydr. Surface Grinder, 10 x 18 x 24" New

GRINDERS—THREAD
EXCELLO: #31 External, dia. 5"x18"
JONES & LAMSON: #636 Universal, 6" dia. x 36" centers and one extra multiform wheel dressing attachment

HONING MACHINES
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia

LAPPING MACHINES
FELLOWS: 8LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES PRODUCTION
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
H.E.B.: High production hydraulic duplicating and copying lathes (new)
LODGE & SHIPLEY: #3A Duomatic 25½" swing x 27" centers
New Engine Lathe 27" swing x 23 centers

LATHES—TURRET
WARNER & SWASEY: 1A, 2A, 3A & 4A
WARNER & SWASEY #3, #4 & #5 Turret Lathes
HERBERT: #2, #4, #7, and #8 No. 9B/30 Sizes (new)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)

MILLING MACHINES
CINCINNATI Hydromatic Duplex, Rise-and-Fall, 34-36, Tracer Control
TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES
CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)

THREAD MILLERS & TAPPERS
HALL PLANETARY: Model "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13½" hole.
MURCHEY: #22 Horizontal threading and tapping machine, ⅛" to 2½" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

WIRE FORMING MACHINES
BAIRD: 4-slide wire former
HEENAN & FROUDE: Wire forming, 4-slide machines (new)

MISCELLANEOUS
ARTER CARBIDE Tool Grinders
OPTICAL PROFILE GRINDER, Wickman, New
OPTICAL PROFILE GRINDER, Sheffield, used.
AUTOMATIC SCREW MACHINE, Swiss type, ⅝"—used
AUTOMATIC SCREW MACHINE, Wickman, Single Spindle, 7/16", New
CENTERING MACHINE: Sundstrand, 44" Double End.
CUTOFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½ & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
LATHES: Blount Polishing Speed Lathe, 12" dia. x 48" centers
HARDNESS TESTER: Gogan Brinell, Model 16-8
SHEFFIELD Precisionaire Gauge
WIRE FORMING MACHINES: 4-slides (new)

INSPECTION INVITED — Telephone HAnover 2-4520

TRIPLEX MACHINE TOOL CORP.

75A West Street, New York 6, New York **Cable Address TRIMACTOOL**

MACHINE TOOL ENGINEERS SINCE 1919

HEADLINERS

LATHES

14"x30" Lodge & Shipley Selec. Grd. Hd.
19"x48" ctrs LeBlond Grd. Hd., a.c., m.d., taper
20"x72" ctrs Lodge & Shipley Selec. Grd. Hd., a.c. m.d.
22"x74" ctrs Lodge & Shipley Selec. Grd. Hd., a.c. m.d., taper
24"x60" ctrs American Heavy Patt. Grd Hd., a.c. m.d., taper
36"x96" ctrs Schumacher & Boye Triple Grd., cone, taper
36"x120" ctrs American Grd. Hd., a.c. m.d., taper
36" (raised to 44") x 157" ctrs American 16-spd. Grd. Hd., a.c. m.d.

RADIAL DRILLS

4'-11" col. Cincinnati-Bickford
5'-13" col. Dreses
6'-16" col. Dreses Full Universal
7'-17" col. Dreses

MILLING MACHINES

No. 1-14 Kent-Owens Hydraulic, a.c. m.d.
48" Cincinnati Plain Automatic, a.c. m.d.
#12B Pratt & Whitney Single Spindle Profiler, Very Late.
No. 4 Cincinnati High Power Universal, a.c. m.d., div. hds.
No. 4-B Brown & Sharpe Heavy Plain
No. 36 Van Norman, new 1943

GRINDERS

A-1-8 ARTER Rotary Surface Grinder, Very Late type.
10"x18" Norton Plain, a.c. m.d.
10"x24" Landis Plain Self-contained, a.c. m.d.
10"x48" Landis Type C Plain Hydraulic, late
No. 13 Brown & Sharpe Universal & Tool, late
No. 49-53" Besley Vert. Spindle Disc
No. 81 Heald Internal, chucking, Size-matic, Gage-matic

TURRET LATHES

No. 1-A Warner & Swasey, Timken, covered ways
No. 601-DD Oster "Rapiduction"

GEAR MACHINERY

No. 3-26 Brown & Sharpe, a.c. m.d.
No. 5A Cincinnati 60"x16", a.c. m.d.
No. 12 Barber-Colman Hobbers
No. 18HM Gould & Eberhardt 2-spindle Hobber
No. 18H Gould & Eberhardt Hobber, a.c. m.d.
6", 11", 18" Gleason Bevel Gear Generators
No. 7 Fellows High Speed Shapers

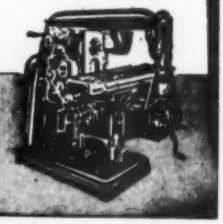
PLANERS

42"x42"x14' Niles-Bement-Pond Heavy Patt., d.c. m.d.
42"x42"x16' Gray, arr. m.d.

MISCELLANEOUS

24" Bullard "New Era" VTL, side head, threading
12'x⅜" Pyramid Type Rolls, a.c. m.d.
1¼" Cone 4-spindle Automatic, bar feed, a.c. m.d.
No. 77 Toledo 85-ton Open Back Press
36" Morton Draw-Cut Shaper
7"x7" Peerless "Mechani-Cut" Saw, a.c. m.d.

Many other machines in stock. Send us your inquiries.



COX MACHINERY COMPANY, INC.

5 MINUTES FROM THE CINCINNATI HOTEL DISTRICT

P. O. BOX 1953 CINCINNATI 1; OHIO
Office&Warehouse 311-313 Bakewell St.,Covington,Ky.

LATE MODEL MACHINE TOOLS . .

AUTOMATICS

2" Model A Cleveland, 1941.
1-1/16" Model A Cleveland, 1943.
No. 00G Brown & Sharpe, 1941.

BROACHES

HP-100 La Pointe Horiz. Broach, 1945

DRILLS

3'-11" Archdale Radial, 1947.
Ma-6 Avey 4 Spindle, H.F. 1943.

GEAR EQUIPMENT

No. 3 Barber-Colman Hobber, 1940.
No. 7 Gleason "Revex" Rougher, 1943
No. 6 Gleason Revacycle Generator, 1940.
No. 72 Fellows H.S. Gear Shaper, 1942.
No. 61 Fellows Gear Shaper, 1942.
10" Pratt & Whitney Hyd. Gear Grinder, '42
5G-11 Geargrind Spline Grinder, 1942.

GRINDERS

10"x18" Norton Plain Type "C", 1940.
6"x30" No. 12 B & S Hydraulic, 1940.
No. 72A-3 Heald Int. Extended Base, 1942
No. 72-A3 Heald Plain Hydraulic, 1942.
No. 24-36 Bryant Hydraulic, 1943.
No. 16A28 Bryant Hole & Face, 1942.
No. 16 CP 16 Bryant Hydraulic, 1942.
No. 172 Heald Hydraulic, Gap, 1940.
No. 24D Hanchett Duplex Rotary, 1943.
No. 16A Blanchard Auto. Surface, 1942.
No. 2 Cincinnati Centerless Grinder, New 1944.
Cincinnati Centerless Lapper, 1942.
HRS Barber-Colman, 1942.
No. 35 Excello Precision Thread, 1942.
No. 7 Grand Rapids Universal, 1942.

GUN BARREL MACHINES

No. ½ B x 50 P & W Reamer, Latest.
No. ½ B x 30 P & W Reamer, Latest.
No. ½ B x 50 P & W Rifler, Latest.

LATHES, ENGINE

27"x192" Niles Timesaver, 2 Carr, 1941
27"x96" Niles Timesaver, 1940.
26"x180" Betts Bridgeford, 1940.
26"x96" Betts Bridgeford, 1940.

LATHES, PRODUCTION

9"x84" Lo-Swing Semi-automatic, 1941
No. 3A Lodge & Shipley Duomatic, 1942
No. 1F U Foster Fastermatic, 1942

LATHES, TURRET

36" Bullard VTL, Spiral Drive, Late.
No. 1A Warner & Swasey Saddle Type, 1941
No. 1L Gisholt Saddle Type, Late.
No. 2A Warner & Swasey Saddle Type, 1940.
No. 7A Jones & Lamson Saddle Type, 1943.
No. 3R Gisholt Universal Saddle Type, 1943.
No. H5 Libby Universal Saddle Type, 1939.
No. 5 Gisholt Universal Ram Type, 1942.
No. 4 Gisholt Universal Ram Type, 1940.
No. 2M-50 Warner & Swasey Ram Type, 1941.

MILLS, BORING

No. 41 Lucas Horiz, 1941.

MILLS, PRODUCTION

No. 1848 Milwaukee Duplex, 1942.
No. 2-18 Cincinnati Automatic, 1942.
No. M-18 Milwaukee, 1943.
M-18 Milwaukee, 1943.
No. 3 Cincinnati Univ. Dial Type
No. 8A CINCINNATI Rise and Fall, 1942
8x16 Hanson-Whitney Thread, 1939.

MILLS, TOOL ROOM

No. 3 Van Norman Plain, 1942.
No. 22L Van Norman Plain, 1943.
No. 2 Saimp Vertical New.
No. 2 Saimp Universal, New.
No. 3 Saimp Plain & Vertical, New
No. 4 Saimp Vertical, New.

PRESSES

Versen 650 Ton Double Action, 1940.
No. 168½ Toledo Toggle.
No. 166 Toledo Toggle.
No. 67 Bliss Consolidated Press

SHAPERS

[illegible] Ohio Heavy Duty Univ. 1951
16", 20", 24" Gernetti Universal Shaper, New

Partial Listing — Write for latest stock list

INDIANAPOLIS *Machinery & Supply Co.*
1961 S. Meridian St. • • Indianapolis, Indiana

"LOOK THESE OVER"

4¼" ACME GRIDLEY Single Spindle Model L Automatic
3'11" DRESES Radial Drill—Motor on arm
16"x8' MONARCH Geared Head Lathe
30"x16' bed AMERICAN High Duty Geared Head Lathe
42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe
No. 5A BRYANT Internal Grinder
No. 172 HEALD Gap Internal Grinding Machine for large swing
6"x18" LANDIS Type C Plain Grinder
10"x72" LANDIS Type C Hydraulic Plain Grinder —1942
Nos. 4D & 6S POTTER & JOHNSTON Automatic Lathes
Nos. 8A and 9A JONES & LAMSON Saddle Type Universal Heavy Duty Turret Lathes
No. 26 VAN NORMAN Universal Miller
No. 2M CINCINNATI Plain Miller
No. 3 CINCINNATI Dial Type Plain Miller
No. 2 CINCINNATI HS Dial Type Plain Millers
No. 5 CINCINNATI Plain High Power Miller
No. 0-8 CINCINNATI Plain Milling Machines
No. 2M CINCINNATI Vertical Miller, 1941
No. 1-18 CINCINNATI Plain Mfg. Miller
No. 12 B&S Plain Bed Type Production Miller
6"x60" P&W Model C Thread Miller
Nos. 64 and 72 FELLOWS High Speed Gear Shapers
No. 12 FELLOWS Gear Shaver 1943
No. 36BM GOULD & EBERHARDT Gear Rougher
16 20" GOULD & EBERHARDT Industrial Shaper
36" OHIO "DREADNAUGHT" H.D. Shaper.
100" BETTS Vertical Boring Mill, 2 heads.

WIGGLESWORTH INDUSTRIAL CORPORATION
203 Bent St., Cambridge 41, Mass.

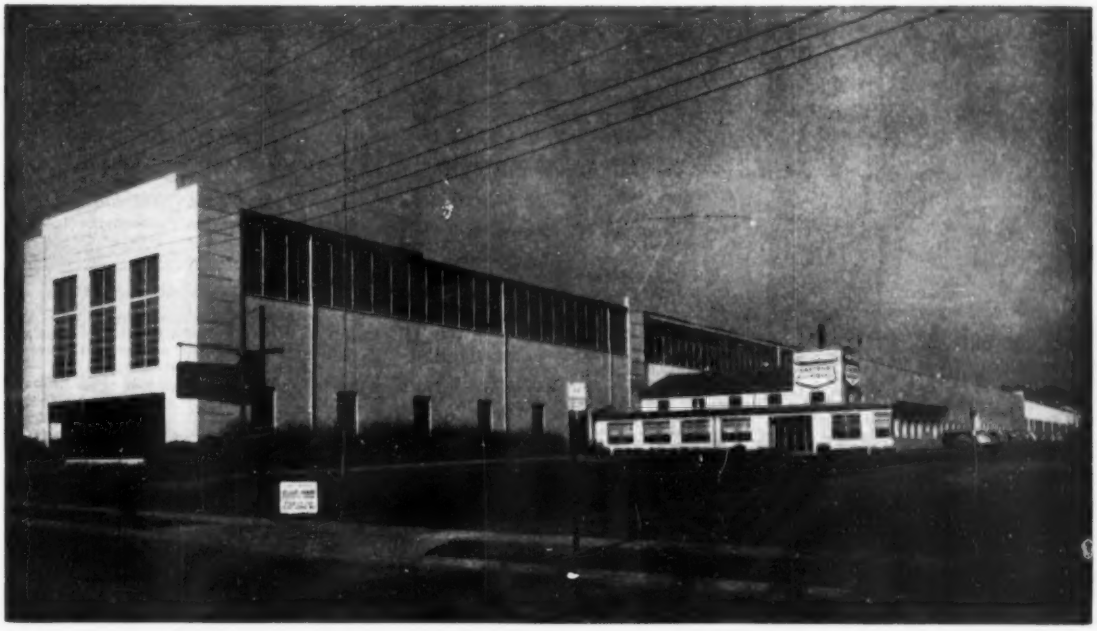
860-B MICHIGAN GEAR SHAVER

Practically New

WINSTON MACHINERY CO., INC.
326 W. Ohio St., Indianapolis 2, Ind.

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY



AUTOMATIC
8A Cleveland, 8" capacity, latest

VERTICAL BORING MILLS
100" and 144" Niles
36" to 54" Bullards, late
108" Cincinnati Hypro Massive Pattern, late

RADIAL DRILLS
American, 2½', 5', 7'
Cincinnati-Bickford, 3', 8', latest

BALL BEARING DRILLS
One to six spindles, Avey, Leland-Gifford, Edlund, Buffalo

MULTIPLE SPINDLE DRILLS
115U Moline
C11 Natco
924 Barnes

UPRIGHT DRILLS
21"-36" Cincinnati-Bickford
315, 417, 513 Baker

GEAR MACHINES
7, 7A, 712, 61, 61A, 615, 615A, 64A, 615 Fellows Gear Shapers

DISC GRINDERS
14, 120A, 124 Gardner

CYLINDRICAL GRINDERS, PLAIN
Cincinnati 6x18", 6x30", 10x18", 15x36", 10x48", 14x48"
Norton, 16" raised to 26x72", latest

CYLINDRICAL GRINDERS, UNIVERSAL
12x48" Norton, latest

INTERNAL GRINDERS
72A3, 72A5, 75A Heald
16, 24 Bryants

HONING MACHINES
182, 306H Barnes
H1, H4 Micromatic

MANUFACTURING LATHES
3, 3A Lodge & Shipley Dusmatics
No. 4 LeBlond, 37' bed
12"x18" Reid Small Piece

ENGINE LATHES, GEARED HEAD
12"x6' Lodge & Shipley
13x54" LeBlond, Timken
15x54" LeBlond, Timken
16x30" Monarch
16x72" American
16x84" Pratt & Whitney
21"x72" LeBlond, Timken
20"x72" Sidney, Timken
20"x72" Springfield, Timken
27"x24' bed American with 12" hole, Timken
30"x40' 2ed Betts-Bridgeford (2), with 11" hole, Timken
36x84" American, Timken
42"x180" American, new 1945

UNIVERSAL MILLING MACHINES
3A Brown & Sharpe, Timken
3B Milwaukee

PLAIN MILLING MACHINES
1B Milwaukee
4 Cincinnati Dial Type, Timken

VERTICAL MILLING MACHINES
No. 3 Milwaukee

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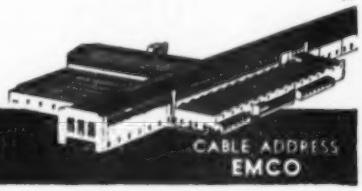
30"x30"x10' Cincinnati
36"x36"x12' Betts, late
42"x42"x14' Niles-Bement-Pond
48"x48"x28', 30' Cincinnati
72"x72"x36' Cincinnati

SHAPERS
24" Gould & Eberhardt
32" Cincinnati
32", 36" Ohio Dreadnaught

TURRET LATHES
#1 Warner & Swasey Electric, late
2F, 3F, 4FU Foster
No. 5 Gisholt, latest
4H12 Libby, late

SHEET METAL
No. 3 Ryerson Rotary Bevel Shear
8'x¼" Dreis & Krump Leaf Brake, latest

THIS IS ONLY A PARTIAL LISTING OF OUR MACHINES IN STOCK.
WRITE FOR COMPLETE LISTING OF ALL TYPES AND SIZES.



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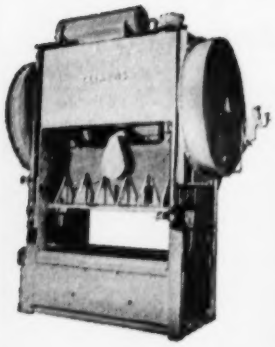

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3½" bar DeBlance, Table (2)
RADIAL DRILL, 5'/5" col. Amer., Motor-on-Arm
DRILL MULTI, No. W-7 Baush, 32 spin., 1947
GRINDER, CYL., 18"x144" Norton, M.D.
LATHES 72"x38' bed N.B.P., blocks to 97"
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42"x28' bed L. & S., T.A., 16 speeds, M.D.
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Cleveland Model B. Serial #42618/843.
Cleveland B18—1½" Cap. Late.
Conomatic 4 Spindle, Serial #2309FF, 1½".
Davenport 9-16" 5 spindle

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Bullard 24" V.T.L. Spiral Drive
Bullard 8"—8 spindle, Multi-Matic
Cleveland 2½" Bar Capacity
Giddings & Lewis #32, 3" #25, 2½" Bar.
Kings 42", 72" Vertical 2 rail heads
Niles-Bement-Pond 4", 4½" Bar, 60" Vert.
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New 3" Horizontal Boring Mill

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American 6'x15" Universal, 4'x13"
Baker No. 321 Vertical Boring & Drill
Bausch Multi-spindle
Buffalo #2 Motor Spindle, #16—4 Sp.
Buffalo: Power No. 41, No. 42, RPMSTERS
Canedy-Otto 21" Sliding head, New
Cincinnati Bickford 6'x15" col.
Edlund 8" Model 2B, Sliding Head
Natco #12, 20 spindle Model B2A—10 Sp.
24" Sibley Sliding head
New Geared Box Col. Drills 24"
Foote-Burt #25 3" capacity
Leland Gifford 2 LMS, 3 MS
Leland Gifford No. 2—4 Sp. Hyd. Feeds
Sigourney 2 spindle

ENGRAVERS
Gorton #ME, 1D, 3U, 3Z, Deckel G1L, G1, G2
Taylor-Hobson 3 dimensional Pantograph
New, 3 dimensional Deckel type

GEAR EQUIPMENT
Barber-Colman Mod. SHS, Sharpener
Barber-Colman #2, #12 (3) also Type S.
Brown & Sharpe #3 Gear Mill, 26" Cap
Cleveland Rigidhobber Mod. 140.
Fellows High Speed Shapers 712, 725, 71, 7
Fellows #20M Redliner, Flather 72" Cutter
Gleason Gear Rougher, Gleason #6 Power Tester
Gleason #2 Surface Hardener, No. 3 Gear Tester
Gleason #3 Spiral, #3 Straight Bevel
Gould & Eberhardt 36" Cutter
Michigan Gear Finisher 24" cap., 862-24A
Mikron No. 79 Gear Hobbers
National Broach Red Ring Lapper, Finisher
Schuchardt & Shutte #1 Hobber

GRINDERS SURFACE
New 9x24" Hyd. Feed, 10x18", 6x18"
Abrasive 8x24", #33 Vert. & #34
Blanchard #16, 26" Mag. Chuck
Brown & Sharpe #5, #2 with Chuck
Gallmeyer & Livingston—Nos. 55 & 65
Heald 22—12" chuck, Arter 12", Covel No. 15
Portman 12" Chuck Rotary—Reid #3, 11"x36"
Pratt & Whitney 12x36" Vertical
Taft Pierce #1 Precision

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125 Ton Southwark Press, Bed 96"x30", 30" stroke, 2 to 4 ft. opening
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250 Ton Watson & Stillman 28x24"
300 Ton Watson & Stillman 24x29"
300 Ton Watson & Stillman 20"x20" Platen 8" St. 19" opening
600 Ton Williams & White 42"x60"
800 Ton Williams & White 42"x60"
800 Ton W&S Hobbing Press
All Hydraulic Equipment is completely engineered and checked by a competent staff thus assuring reliability.
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Brown & Sharpe #2 Universal 14"x28", #3 Univ.
Brown & Sharpe #5, 3"x18" Cylindrical
Brown & Sharpe #13 Universal Tool & Cutter
Bryant #5 Internal, chucking
Cincinnati 6x18" Hyd. #4—Centerless—#2
Douglas Tool & Cutter 8"x15"
Gardner Disc Grinder 30"—15 H.P. Motor
Grenby Models 1G1 & 1G2—Internal
Gorton Ped. Type Tool Grinder Mod. 375-2
Heald #73 Internal Centerless, #75A Internal
Heald 72A3 Int. Centerless Sizematic
J. & L. Thread; TG615, Lempco 54" Swing
Landis 6"x30" Type C Cyl., 10x24 Univ. 12x30
Norton #2 Tool & Cutter, No. 1 Tool & Cutter
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 10"x18" Type C cylindrical, 6"x30" Cyl
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
Pratt & Whitney Radius Model R6
Sellers 6-G Drill Grinder, 6G Tool, K.O. Lee tool
Van Norman #666 Crankshaft

LATHES
American 12"x30", Bridgeford 36"x20", 32"x16'
Boyes & Emmes—24" G.H.—Bradford 16"x36"
Gisholt Simplimatic 18"x16½", 2 Tables
Hendey 12"x42" and 12x30", 1941, 14" Yoke
LeBlond Regal 10"x3' bed, 13x42"
LeBlond 25/50x96" Gap, Late type.
Lipe-Carbo 12"x18" (2)
Lodge & Shipley #3A, Duomatics
Pratt & Whitney 16"x60, 10"x20", 16"x36
Monarch Magna-matic 14"x54"
New 16, 18, 20", 28" Immediate Del.
New Tool Maker 10x24", South Bend 9"
Rivett Model 918 Precision. Mod. 715
Putnam, Sliding Gap 22"/46"x92"
South Bend 13"x5' Q.C.G.
Sundstrand 8x15", 15' Stub
Wickes 32"x35' Geared Head

MILLS, PLAIN, UNIV. PROD.
New #2, Univ., Dividing Hd.
Brown & Sharpe #0 Omniversal, #000 Production
Brown & Sharpe #2B Plain, No. 2, 3A, 21, #2L
Cinn. 08 Rise & Fall 2-24 Automatic
Cinn. No. 3, 4 Plain Spd., 18" Manufacturing
Kent Owens IV, 1-8, 1-14, 1M
Kempsmith #1 Pl., Vert. & Div. Hd
Milwaukee 2H Universal
Milwaukee #2B, Plain & Univ.
Nichols Horiz. Hand and Pneumatic Feed
Sundstrand #00, 0, Rigidmils
Sundstrand #3A Rigidmil with copying Attach, 33
Van Norman #2L Univ., Dividing Head
Van Norman No. 12

MILLS, VERTICAL
Cincinnati (2)—1-18 Plain Automatic
Cincinnati #3, #4 hi-power, 08 Vertical
Cleveland No. 1 table 8"x32"
Gorton 8D Super Speed
Morey #12M Profiler, 2 sp. #2 Maximiller
Reed Prentice Vert. Mill & Die Sinker Mod. 3VG

PRESSES
Bliss No. 1 Double Action Drawing Presses
Bliss 650 Hi-Production Presses
Bliss 18, 19, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton SS, Bliss 74½
Bliss S-48 Dbl. 32x48" bed, Cushion
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Niagara Herning, 15 Ton—Toledo 32 Ton Honing
Niagara A13¾, O.B.I., Niagara No. 27
Stokes Tablet Presses, type R, Late, Model F
Toledo 92½c Double Crank 43x23" bed
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton, LI #3
Z & H #4½, O.B.I. 20 Ton

TURRET LATHES
Bardons & Oliver #2, 3, 5, 7. Bar Feed
Brown & Sharpe, #2 Hand, #10, 11
Foster #2B 2½ Cap. Morey #2G Late
Gisholt 2L, Cross Slid. Tur.
Gisholt #5, Bar Feed, Plenty of Tools
Gisholt 4R—9¼" hole in spindle
Libby 1 HS with threading att.—3R 4R
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1, 1A, 2, 2A, 3, 4, 5

MISCELLANEOUS
Band Saw: New Kalamazoo & Johnson
Bolt & Pipe Threader: Landis, Oster-Williams
Broach: New 6 Ton, Horizontal. 11 Ton, Vertical
Hacksaw: Peerless 6"x6", Racine 6"x6"
Jig Borers: New Swiss
Keyseater: Davis, Baker
Pipe Bender, Kane & Roach. Parker tube 1½" Cap.
PLANER: Niles-Bement-Pond 36x36'x10', Gray 24"x24"x8', Detrick & Harvey 40x90"
Rotary Table: Cincinnati, power take-off
Saw: Shaping 6x6", 13x13", Tannewitz Cut Off
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6D Potter & Johnston Automatic Chucking Machine Serial #70393
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FOR SALE
1—Heald Sizematic, completely rebuilt by the Heald Machine Company within the last 90 days, serial No. 6887.
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BE *Sure* YOUR NEW ENGINE LATHE CAN *Take* IT!

The engine lathe you buy today could be the one you will call upon for 'round-the-clock production. Make sure, before you buy, that the lathe of your choice can take such punishment.

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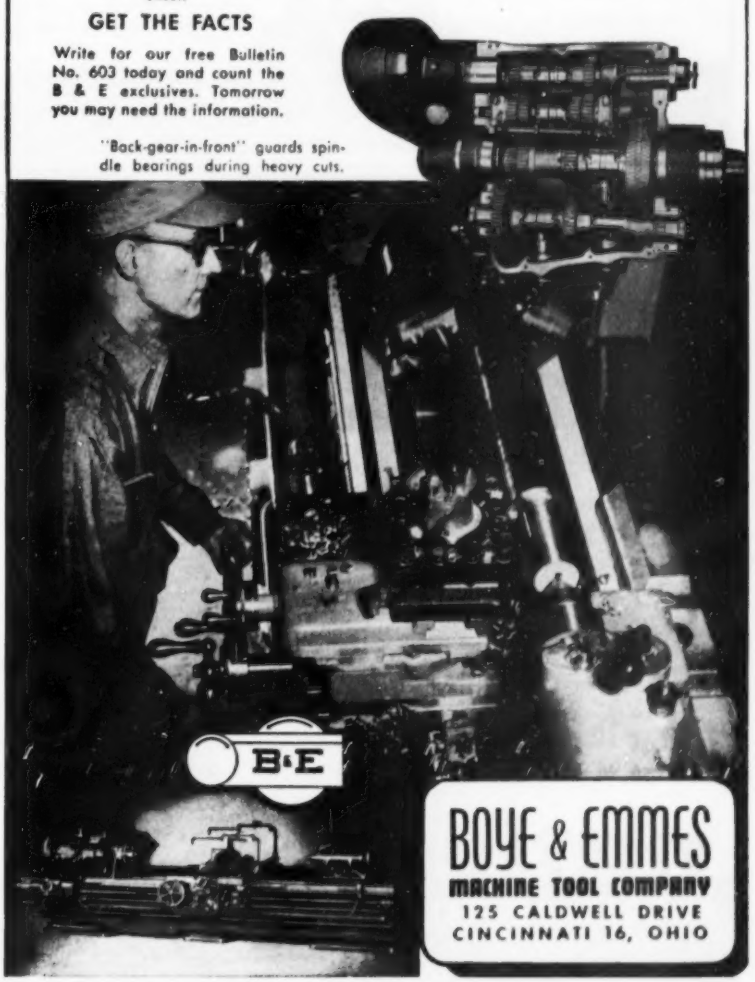

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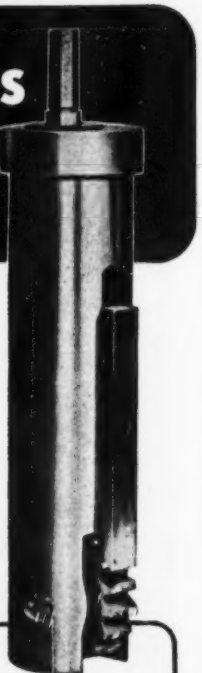

They will mill keyseats:

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- for interchangeable parts.
- without clamping the work.
- of standard width and depth.
- in holes that are closed at one end.
- where keyseating machine can't reach.

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complete, handy size

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AUTOMATION with FEDERAL WELDERS CAN CUT COSTS!

Automation is a word invented by production-minded people to describe the automatic handling of material in process, the combining of two or more operations into a single operation to reduce costs and speed production.

Perhaps one of the greatest advances of automation has been made in the resistance welder field where Federal has taken the lead in designing and building welders that have successfully combined forming, handling and/or assembly with welding.

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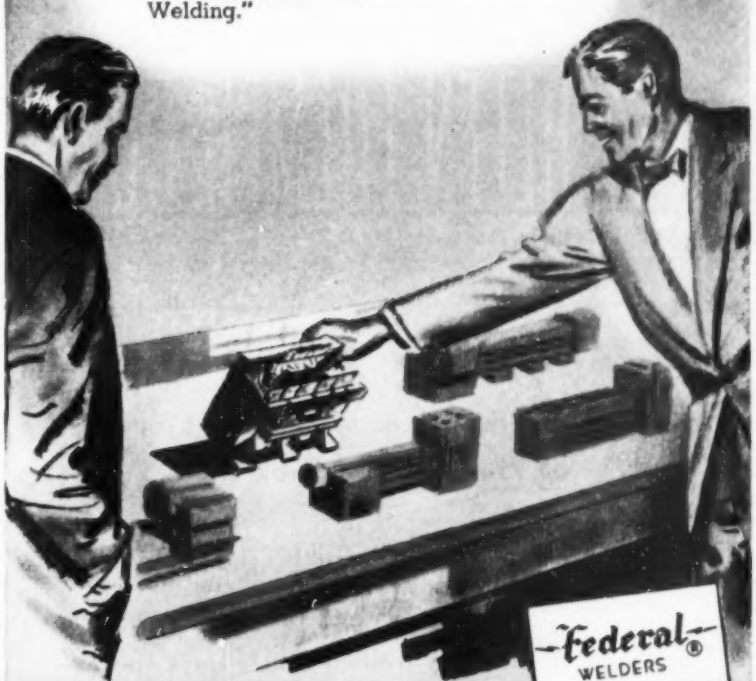

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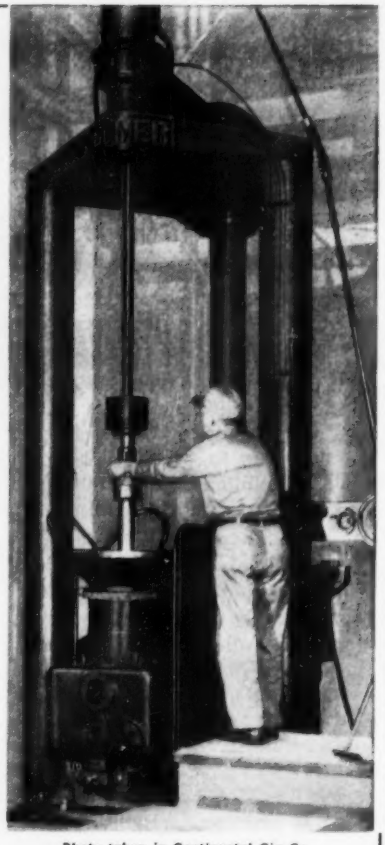

Photo taken in Continental Gin Co., Birmingham, Ala., honing Diesel cylinders.

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TAKE a man's pride in his job away, and there isn't much left; he becomes another automaton. Even a trained seal enjoys the applause as much as he does the fish.

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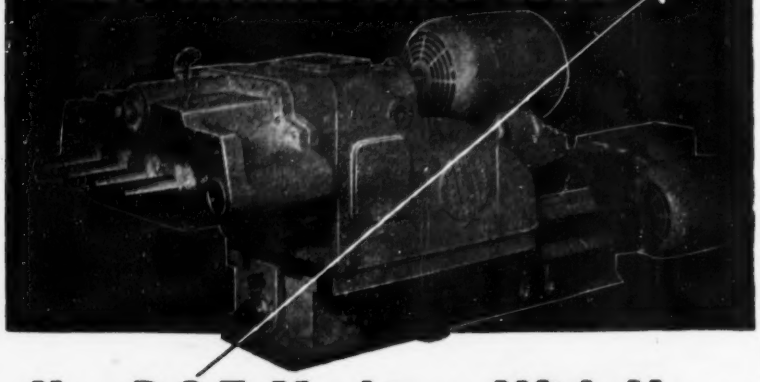
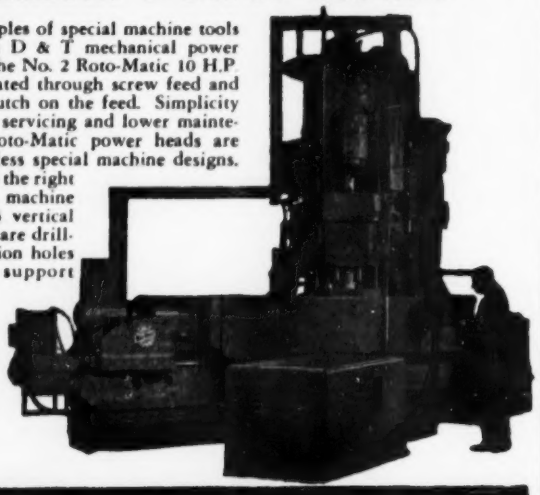


Use D&T Machines With New Mechanical Power Heads

Here are two good examples of special machine tools designed and built with D & T mechanical power heads. Shown above, is the No. 2 Roto-Matic 10 H.P. head. All sizes are operated through screw feed and have overload release clutch on the feed. Simplicity of design makes for less servicing and lower maintenance costs. D & T Roto-Matic power heads are readily adapted to countless special machine designs. For instance: Machine to the right is a 6 station indexing machine with 3 horizontal and 3 vertical power heads. Operations are drilling and reaming suspension holes and king pin holes in support arms for power heads.



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is available on the complete line of D & T machines. Ask for Bulletin 1000.

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Davis & Thompson Company

6411 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN

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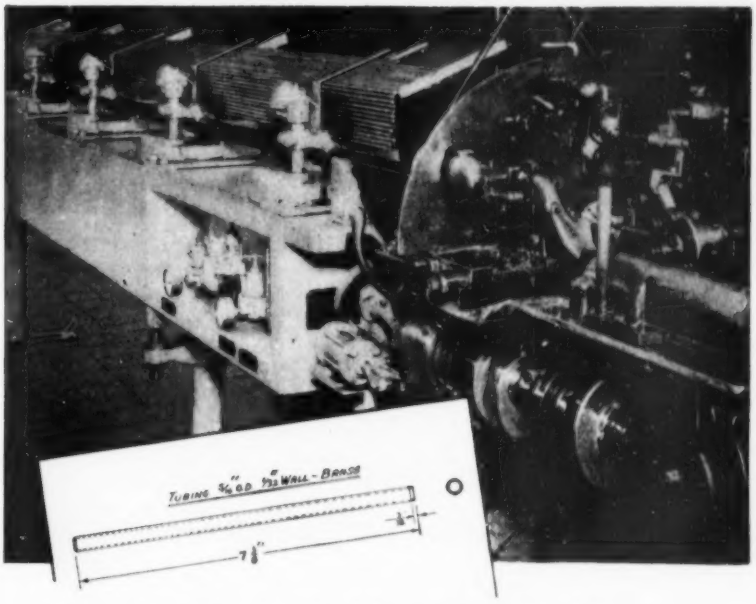
Increases Actual Gross 71%....

Produces 94% of Increased Gross!



Another Screw Machine Record with

LIPE *Automatic Magazine Loading* BAR FEED

THE JOB—Part shown above made by Trico Products Co., Buffalo, N. Y., on #00G B&S Screw Machine. Length of this part required 7 feed-outs of the feed fingers. Cycle time: 3 secs.—an actual gross of 1200/hr. Best average production with one man handling this and one other machine: 600/hr.

THE IMPROVEMENT—Lipe Automatic Magazine Loading Bar Feed was installed on machine producing part. Cycle time cut to 1¾ secs. Actual gross upped to 2057/hr. A.M.L. Bar Feed, eliminating "cutting air," obtained 94% of actual gross, or 1930 pieces per hour. *A production increase of 221%! Further savings: Same operator now runs four machines, two equipped with A.M.L. Bar Feeds.*

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BIG Production Gains on a wide variety of work, BECAUSE—

- Stock is fed to screw machine all the time—not dependent on operator.
- Feed-out pressure always behind stock.
- Eliminates feed fingers.
- Avoids multiple feed finger feed-outs.
- Model AML gives maximum output of machine—no "cutting air."
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HIGH SPEED [SPECIAL] RIGHT HAND TAPS

SIZE	THREAD
4	32-48-60-64
5	30-32-36-40-44
6	30-40-48-56-60
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	28-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-28-32-36-40
5/16	16-20-22-27-28-32-40
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
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3/4	9-11-12-14-18-20-24-26-27-28-32
13/16	10-14-18-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-16-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
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3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	6
4	8-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
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1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
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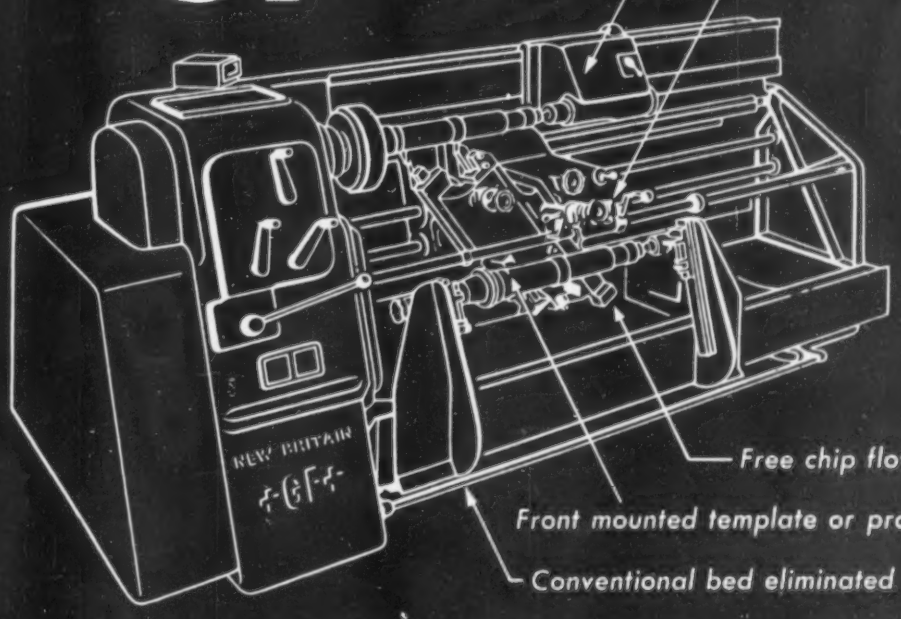

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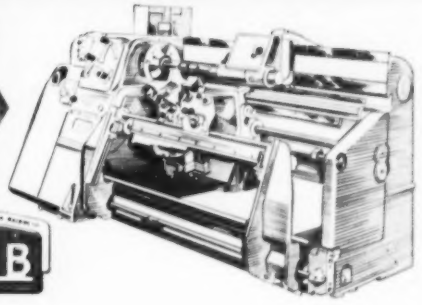

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EVERY so often, a machinery maker comes to the Timken Company for help with a very special bearing application. Something, he's pretty sure, we've never encountered before.

Almost always, we're able to give him a pleasant surprise. In over 50 years of helping manufacturers with special bearing problems, all the while improving our designs, we've produced an astonishing variety of tapered roller bearings. So many sizes and shapes that the "new" bearing has usually already been designed and made by the Timken Company. So many that the "new" design problem has usually been already solved with the help of Timken Company engineers.

If the people who buy the machines ever have occasion to replace a Timken® bearing, they get the same kind of pleasant surprise. Even when a machine's very old, they can almost always get immediate delivery on Timken bearings for replacement.

Be sure that every bearing you use in the machines you buy or build is stamped with the trademark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN *TAPERED ROLLER BEARINGS*

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION